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THE ESIA TEAM

Team Leader-Nicollete Mhlanga is currently studying towards a PhD in Climate change Vulnerability and Adaptation in the Sugar Sector of Swaziland with the University of South Africa. She holds an MSc in Integrated Water Resources Management (IWRM), (Specialised in Water Policy and Development) obtained from the University of Zimbabwe. She has been involved in project management, client and project team liaison, developing reports such as (EIAs, EMPs, etc.) and in proposal writing, project co-ordination, planning and administration, budget compilation and managing all aspects associated with public participation. ·Nicollete specialises in policy analyses and development for natural resources management including agricultural and rural development, water and environmental resources management. She has vast experience in Public participation processes and capacity building / institutional support gained in Swaziland and in Kenya. She has good leadership skills having worked as Team leader for environmental and social impact assessment with multidisciplinary specialists.

Environmentalist 1-Gilles Pahin has a Master's degree in geography (including ecology) and Degree in Nature and Life Sciences all obtained from Paris XII University in 1987 and 1982 respectively. He has worked in countries such as France, Zambia, Djibouti, Madagascar, Morroco, Tunisia, Chad, Jordan, China, Dominican Republic and Latvia as an environmentalist. Gilles is the Project Director in charge of the supervision and the development of Environmental Assessment studies, in charge of Organising and planning project staff, Coordination with institutions, Supervision of subcontractors, Specific expert appraisals covering environmental issues, Quality control, Reports preparation and presentation, Knowledge transfer. He is an experienced Environmental Expert performing specific appraisals in several areas: environment (hydro-ecology, bioengineering, landscape), town planning (land-use organization, planning), permitting (permits and public utility surveys) and works (environmental management plans and environmental monitoring)

Environmentalist 2-Thobile Khumalo is the Director of MTK Sustainable Technologies, which was established in 2010. She Holds a Master of Science degree in Analytical/ Environmental Chemistry, a Bachelor of Science degree (Chemistry and Maths majors) from the University of Swaziland, as well as a Post Graduate Diploma in Business Management (PGDM) from Athabasca University, in Alberta, Canada. She has worked as a lead consultant for a number of projects in the housing industry (Bhaiprop and Pineview Townships), sanitation (Zakhele and Matsapha gravity sewer pipelines), Waste management projects (Lomahasha Solid waste disposal facility), Mining sector (Piggs' Peak Quarry, Ngwenya Mine), food processing industry (Swaziland Fruit Canners) as well as the hospitality industry (The George Hotel extension). She has worked as an Environmental Engineer and an Environmental Inspector with the Swaziland Environment Authority (SEA) since 2003 to June 2010, where she was evaluating and recommending environmental clearance of environmental impact assessments, environmental audits, and project compliance reports and conducting inspections to ensure compliance of a number of projects. She was also responsible for pollution control, chemicals and waste management. She has been exposed to international fora in these issues. She was the national focal point for the Stockholm Convention on Persistent Organic Pollutants (POPs), the Strategic

Approach to International Chemicals Management (SAICM) and the Rotterdam convention Prior Informed Consent on International Trade of Certain Chemicals and Pesticides. She reviewed a wide range of projects and operations to recommend issuance of the environmental Compliance Certificate (ECC).

Social Facilitator 1-Charles Pendley has over 28 years of experience in the identification, preparation, appraisal, planning, implementation, and monitoring and evaluation of programs and projects in the water sector (rural and urban water supply and water resources management); design, planning and supervision of social surveys, poverty, baseline and impact studies; institutional analysis; design and implementation of community mobilization, public participation and stakeholder analysis, conducting in-service training, stakeholder workshops and consultations in the socio-economic aspects of development projects for a wide range of development partners at regional, national and local levels in Asia, Africa and the former Soviet Union.

Social Facilitator 2- Sindisiwe Nxumalo possesses an MA in Sociology obtained from the University of London. She is a Sociologist specializing in qualitative research using participatory methodologies. Key experience is in social impact assessments for NGO projects as well as large-scale infrastructure projects as a field co-ordinator for large teams, employing both qualitative and quantitative survey instruments. She has fifteen years experience in facilitating community discussions and presentations with urban and rural communities in Swaziland.

Hydrologist- Damien Brunel is a senior engineer specialised in water management for development, and as a qualified engineer of the ecole nationale supérieure d'hydraulique et de mécanique de grenoble, damien specialises in the integrated management of water resources is experienced on every aspect of iwrm (water requirements, prospective needs, estimation of water resources available, modelisation of complex watershed…). he gained wide experience in iwrm in his work in france where he determined water resources availability for many projects such as irrigation schemes (sometimes with creation of dams), estimated the potential of water withdrawals for various needs at a catchment basin scale with respect to the environmental constraints. he also has experience at an international level (water resource studies in algeria, technical assistant and hydrology expert for the international commission of congo, feasibility study and preliminary design of the consolidation of the kayanga river from the koulountou river in senegal, designed the hydrological measurement network in haiti, performed hydrological studies in morocco at the country scale…). he has also undertaken studies to estimate the impact of climate change on water resources in specific basins (based on ipcc scenarios.

Resettlement Specialist-Robinson Dlamini is a Resettlement, Social Researcher, Monitoring and Evaluation and Public Participation Specialist. He has undertaken resettlement projects both in the Republic of South Africa and Swaziland mainly in the Maguga Dam, Driekoppies Dam, LUSIP Dam, Mafube Colliery Project in Middelburg and compilation of the Environmental and Social Impact Assessment for the construction of Siphofaneni Bridge and upgrade of the St Phillips road. His strength is that he is easily trainable towards the specific need of an organization should the need arise.

Gender Specialist-Phumelele Thwala possesses an M.L.I.S. (Masters in Library and Information Services); from Dalhousie, Canada, an LLB from UNISWA and a B.A. (LAW) Arts from UNISWA. She is a Leader of own company and has over 16 years in gender & development, human rights, constitutional law consultancy work; She has hands on experience in the LUSIP and KDDP; Extensive experience in gender issues in land distribution, land-based development and farming in Swaziland; Excellent facilitator of stakeholder consultations and community dialogues; Ability to write competitive proposals and tenders under projects funded by institutions such as the European Union, OSISA, UNDP-Swaziland, World Bank; Ability to facilitate and drive participatory organisational transformation initiatives; Excellent writing skills expressed through consultancy reports, training materials, conference papers and research publications; Excellent in inter-personal, empowering, team-building and facilitation skills across all demographic groups and various nationalities and cultures; Passionate in building both individual and institutional capacity for sustainable, and profitable development; Versatile communicator through audio-visual and written medium

Livestock Specialist-Boyce Malima has a Postgraduate certificate in Animal Production Systems (Cattle and Small Stock); obtained from the University of Pretoria. He has extensive knowledge and experience in animal husbandry practices and his work covers all species of farm animals kept in Swaziland. He has been involved in dairy and beef cattle production, feedlot operations, piggery, poultry, sheep and goats. He is also involved in research and lecturing covering aspects such as digestive physiology and herbivore nutrition, dairy science, animal feeds & feeding, beef production and small ruminant production.

Botanist-Linda Loffler has Honours in Natural Environmental Science (Earth Sciences) obtained from the University of Sheffield in U.K. She is an environmental scientist and field botanist with professional experience of carrying out a range of consultancies and ecological assessments in Swaziland, South Africa and Mozambique. She has been involved with biodiversity conservation in Swaziland for many years, working with both the private and government sectors. She has experience in mapping indigenous and alien invasive vegetation, carrying out vegetation surveys and doing vegetation monitoring on a local and national scale. She has been conducting research on Swaziland's flora for the past ten years and has published several books and articles including the Swaziland Tree Atlas with Selected Shrubs and Climbers.

Zoologist-Warren Mc Cleland has more than 14 years experience in conducting baseline surveys, data analysis and report writing in various biomes in southern Africa, particularly savannah, forest and grassland biomes. He has 5 years experience on game reserve management (KwaZulu-Natal, Mpumalanga). Warren was the Co-author of authoritative Field Guide to Trees and Woody Shrubs of Mpumalanga & Kruger National Park, Jacana Publishers, 2002; He has Specialist knowledge of identification of vascular plants. He has Specialist knowledge of identification and ecology of mammals, birds, reptiles and amphibians;

Economist-Martin Kuhn possesses an MA-Global Political Economy from the Kassel University/Germany. He is an experienced. Economist and administrator; experienced process and program manager in implementing complex development programmes in the field of institution-al and economic development, in particular providing guidance for or

implementing financial and economic feasibility studies (during the last 30 years): He has worked for the Danish Government (i. establishment of an agricultural cooperative sector in Tanzania and Kenya – among others economic advisory support to a major smallholder sugarcane scheme- ii. regional co-operation in the Middle-East focusing on process management and the economics of agricultural projects in four countries), iii. Feasibility study of maize production in Zambia, iv. Economist on identification mission in Uganda, v.feasibility study on environmental abatement measure regenerating a river system in Asia, vi. lecturing on feasibility studies at agricultural university in China. World Bank (financial/economic feasibility of national water supply scheme, economics/feasibility of seed production in China, coordinating regional development in Northern Poland covering social and economic sectors of public and private sector development needs). European Commission (supporting economic restructuring in Czech and Slovak Republic(s) as program manager of and national co-ordinator for national and sector programmes), Experience from private sector of international companies as finance manager with focus on budgeting and reporting (DuPont, Dunlop, Corn Products). He conducted a major feasibility study on establishment of agro-forestry center in Eastern Europe).

Other Experts

The ESIA team worked in collaboration with the engineering and economists team who conducted the Feasibility and the water and sanitation studies of the proposed project

ESIA EXECUTIVE SUMMARY

E1 The ESIA Study

This report is an Environmental and Social Impact Assessment (ESIA) of the LUSIP 2. It was prepared by BRLi (France) in association with SSI Engineers and Environmental Consultants (South Africa). This Report has been prepared following a request by the Client-Swaziland Water and Agriculture Development (SWADE) to the consultant to develop an Environmental and Social Impact Assessment (ESIA) and an Environmental and Social Management Plan (ESMP) for the Lower Usuthu Irrigation Project 2. The comprehensive ESIA study was prepared in accordance with World Bank standards and the Swaziland Environmental Audit, Assessment and Review Regulations, 2000. The ESIA was prepared through the involvement of national and international specialists of diverse expertise and it entailed stakeholder consultations, review of relevant documents, field visits and lessons learnt from similar projects such as the Lower Usuthu Smallholder Irrigation Project (LUSIP 1) and the Komati Downstream Development Project (KDDP).

E1.1 Objective

The objective of the assignment was to prepare a detailed ESIA and ESMP to address the anticipated negative environmental and social project impacts of the project.

E2 Project Description

The proposed bulk water supply scheme would consist of:

- a main supply system comprising 6,580 m double diam 1.8-2.0 m steel or GRP pipe and 28,187 m of concrete lined canal, at a gradient of 0.2m/km, with a capacity of 7.3 m3/s to supply 10,450 ha according to scenario 3;
- a secondary pipe network in LUSIP 2 supplying 5,750ha in irrigation blocks of 100-500 ha, including pump stations to supply water at the required pressure at the entrance of the blocks;
- increase of the capacity of the LUSIP1 bulk water supply canal (Main Canal South);
- potable water supply and sanitation facilities
- a road network which will facilitate all weather transport and the evacuation of the produce and a drainage network, which will evacuate the excess rainfall runoff; and
- a tail-end dam with 2.5 MCM net storage capacity and supplying 2,421 ha, important buffer or regulation component, that will render water management in this upstream controlled irrigation scheme much easier and more efficient.

The proposed on-farm development systems would comprise:

- pipe systems and center pivot or semi solid sprinkler systems, if necessary pressurised by small block pump stations; and

- if preferred by developers, furrow irrigation systems provided soils and topography are suitable to achieve economically viable sugarcane farming with this type of irrigation.

E3 Legislative Framework

Chapter Three of this project report outlines several legislative issues that were considered during the exercise. This is to ensure that the proposed project complies with the relevant legislative and planning requirements of the country. They generally comprise of legislations that encompass laws relating to environment, agriculture, water, public health and land. The project in question generally conforms to the legal requirements outlined in Chapter Three and is subject to the ESMP proposed in a separate document.

E4 The environmental and Social Setting

E4.1 Location and Climate

The LUSIP 2 project area is situated south of the Usuthu River, between the areas of Siphofaneni and Big Bend. The LUSIP II study area lies in the Eastern Lowveld which has a mean July winter temperatures of 17ºC and a mean January summer temperatures of 27ºC. According to the Köppen climate classification the Lowveld has a dry and hot steppe climate (BSh). The Eastern Lowveld has summer rains from October to March and a short dry cool winter from June to August. Maximum temperatures during the summer months are high and often exceed 35ºC, with absolute maxima close to 45ºC, especially in recent years. There are indications that temperatures in the past 10-20 years have increased as a result of climate change. Average minimum temperatures during the winter months range from 4 to 10°C. Freezing point is reached occasionally in June or July, with occasional ground frosts in valley bottoms. Average annual rainfall is 590mm at Big Bend, with 70-80% falling during the summer months. However, annual rainfall varies greatly (300-1,000mm) and drought is frequently occurring. Average annual reference evapotranspiration (Eto) in Big Bend is high, about 2,300mm.The Greater Usuthu and Mhlathuzane rivers are the only perennial natural surface water sources in the Project area. There are a number of seasonal water courses draining into these rivers.

The area extends south of Nsoko and the Ngwavuma River, which forms the southern boundary, and lies adjacent to the Nisela Game Reserve, making the area a sensitive wildlife environment. It covers communities under three chiefdoms; Ngcamphalala, Matsenjwa and Mngometulu Chiefdoms. The specific LUSIP 2 project area is part of the Maputo River Basin which extends over three countries (South Africa, Swaziland and Mozambique) and consists of two main rivers, the Usuthu River and the Pongola River, which two rivers join at the border of South Africa and Mozambique and flow north as the Maputo River to the Indian Ocean. The majority of the project area is part of the Usuthu catchment, but the southern portion lies within the Pongola catchment.

E4.2 Geology and Soils

The overall geology of the LUSIP Project Area is characterised by the formations of the Karroo supergroup, consisting of Ecca claystones (or shales) and sandstones, Nkondolo (or Cave) mature fluvial and aeolian sandstones, and the Sabie River (or Stormberg) series basalts, as well as by dolerite intrusions from a somewhat later date. Soils in the study area are generally made up of moderately steep low ridges with regular rock outcrops, very shallow soils to gently sloping moderately deep soils and deeper developed Rondspring soils with depths between 70 and 100 cm or even 150 cm. The majority of the soils here are deep mostly poorly drained very dark gray to black strongly cracking clay soils, which are moderately deep, moderately well to imperfectly drained dark reddish brown clayey soils. This implies that the need for training farmers on land and water management is important for control of salinisation, erosion and nutrient leaching to nearby water sources.

According to the Soil Survey conducted by consultants during the Feasibility phase, the results of the Agro Ecological Zone (AEZ) analysis of the investigated LUSIP 2 Study Area indicate that only about one third of the total land shows potential for irrigated agriculture with most suitable crop sugarcane, apart from vegetables. For other crops the suitability is less. Cotton also comes out as relatively favourable, due to its capacity to deal with relatively high pH, high sodium and high clay content. Maize and a group of crops with corresponding requirements come out with moderate to marginal suitability for a range of soils. Banana and citrus overall ratings show the same as maize but these crops have a larger number of restrictions because of their inability to cope with high clay contents, high pH, poor drainage and alkalinity. Summer vegetables would perform relatively well as they only require shallow to moderately deep soils.

E4.3 Water Quality

The water in the Usuthu River, Mhlathuze and other streams in the project area is contaminated with microbiological contaminants as their levels were found to be exceeding the standard set in the Water Pollution Control Regulations, 2010. Phosphate levels were found to be high. There were also high levels of turbidity. Sulphates were found to be slightly higher than standard for the Usuthu River. The study did not find any heavy metal contamination. The current situation is indicative of the need for capacity building on nutrient and water management as sugarcane is a water and nutrient intensive crop.

E4.4 Flora

Much of the project area is a complex mosaic of degraded secondary woodland / thicket, cultivation and untransformed habitat. Eight vegetation communities are evident within this project area, based on distinctive vegetation structure (grassland, woodland, thicket, etc), floristic composition (dominant and diagnostic species) and position in the landscape (mid-slopes, terrace, crest, etc). Over 50% of the project area has already been transformed through cultivation and rural settlement, and the existing vegetation communities refer to the 45% of the study area that still has natural vegetation cover.

E4.5 Fauna

A total of 121 mammal species have been recorded from Swaziland, with highest species richness being recorded in the north-east and north-west of the country. The LUSIP 2 project area is situated within the quarter-degree square 2631 DD, which is one of only seven QDCs that reported a mammal species richness of 46-62 species. This is most likely because of the presence of a protected area, the Nisela Private Nature Reserve, covering much of the QDC. Nine mammal species were recorded in the study area during fieldwork. High species richness was reported for carnivores, herbivores and rodents in 2631 DD, but low species richness for bats and insectivores. A high number of a total of 196 species have been recorded in the Phase 2 area, of which 133 have been recorded in terrestrial habitats apart from waterbirds, which were mostly recorded in the vicinity of the Usuthu River, four major terrestrial bird assemblages were identified, surveyed and summarised. Fourteen species of reptiles were confirmed to occur within the Phase 2 area, although no frogs were recorded. Two of these reptiles have a threatened status in Swaziland (Monadjem et al., 2003) and are classified as Vulnerable (Southern African Python, Nile Crocodile).

E4.6 Biodiversity

A qualitative integration of conservation importance and functional importance values for the different vegetation communities represented in the project area provides an indication of the biodiversity values of these communities. *Ficus sycomorus-Trichilia emetica* Tall Closed Woodland has the highest biodiversity value in the project area, and is the only community that scores High for Biodiversity Value. The project proponent will have to only clear land that will be utilised and preserve as far as possible land outside of the project activities.

E4.7 Socio-Economics

The project area is about 215 km^2 and has a population density of about 67 habitants per km^2 at average. There is, in total a population of about 14 276 occupying about 2 256 households. Matsenjwa Chiefdom has a population of about 1 864 with about 280 households, Ngcamphalala has 6365 people with 1012 households and Mngometulu has 6047 people and 967 households. The population is projected to be 19, 552 in 2022 with an annual growth rate of 2.9% (Swaziland statistics). The results indicated that 52% of residents are female and 48% are male. The average number of occupants in each household is 7.7 persons and ranges from 1 – 26 occupants. About 27.4% of the population in the project area has never been to school, of those who attained education; a majority went up to grade 7. There is a very small portion (1.36) of the population that attained tertiary education (LUSIP 2 Baseline Survey Report). About **19.05%** of the residents are in paid employment, while a further **35.3%** are currently at school. Only **21%** of individuals are said to have an income. Income levels range from E50 per month to E30000 per month with the majority falling in the E200 – E500 range. There are a wide variety of businesses owned by residents. **10%** of businesses owned are sewing; selling dairy products; grocery shops; transport; bar / restaurants and sugarcane farming. **20%** are hair salons and street vending or hawking.

There are 5 health facility centres within the LUSIP 2project area's vicinity which are namely the Ubombo Sugar hospital, Bholi clinic, Ndzevane Clinic, Lubulini clinic, Big-Bend Correctional Services clinic and the Ikhwezi Joy clinic. There are 19 schools within the Project Development Area (PDA) run by government, private and religious organizations. There are also a number of pre-schools run by community and religious organizations as well as private individuals. There are two main roads in the project area, both running in a north-south direction from Big Bend: MR8, an asphalt road connecting Big Bend with Lavumisa on the border to South Africa and a secondary gravel road running parallel to the MR8 connecting Big Bend with the village of Nsoko to the south. Radiating from these two roads is a network of tertiary dirt roads connecting settlements and homesteads. The project area has electricity as it has been shown that 49% of the households use electricity. In the list of assets it has been reported that some households have fixed phones or landlines which indicates that there are telephone services within the area of the project. The stand-pipe or tap is the most common source of drinking water at **60.4%.** The river is the next common source at **17.6%** very closely followed by the borehole at 16.7%. The most common type of latrines is the simple pit latrine **(60.5%)** followed by the Ventilated Pit Latrine **(39.5%).** About **33.1%** of the households have a homestead garden. The proposed project therefore, has a potential to lift the peope within the project area out of poverty as is the Government's main objective.

E4.8 Livestock Management

Livestock, especially cattle play a very significant role for the existing mixed farming system and provide many practical, productive, economic and cultural services in the project area. Culturally, the Swazi people keep cattle for both social and economic reasons, with most relying on the sale of cattle only when a financial need arises or for use in cultural and family activities such as traditional weddings, dowry, for funerals and occasionally for the payment of fines to traditional authorities. The animals are a source of milk, meat, draught power, social security, money as well as prestige for their owners. This cultural orientation appears to be the most influential factor in how the animals are kept and whether or not they are sold as well as when they are sold.

The rangelands within the project area are invariably overstocked, with only the Gangakhulu pasture having a stocking density of 5.69ha/LSU, which falls below the recommended 2.8 - 3.8ha/LSU for the area. Confinement of the livestock within these pastures would only serve to exacerbate the problem unless the herd sizes are either reduced or more land is allocated for grazing. In the currently overgrazed pastures it is imperative that they are fenced off and rehabilitated prior to the project commencement in order to establish a healthy stand of the palatable grass species to facilitate sustainable grazing. The constant availability of drinking water is imperative for maintaining a healthy, productive herd of livestock. There is a need for the provision of drinking water for livestock in all the designated grazing areas. Since these will be divided into paddocks for sustainable grazing, there should be water troughs in each paddock. Since the project will result in reduction of available grazing area, other means of promoting livestock production will have to be provided through capacity building and policy initiatives from the end of the Government. .

E4.9 Public health

Water supply, sanitation and nutrition were identified as the most positively impacted health determinants. The project has the potential to increase the risk of infections by creating additional habitat for the snail vector and increasing exposure of the population, especially children, to water. The study identified Malaria, Schistosomiasis, HIV/AIDS, drowning, exposure to hazardous waste and indiscriminate disposal of clinical waste generated from home base care as the most negatively impacted health determinants. Major mitigation measures identified were that there is an urgent need that the project design includes a system of medical waste disposal. Development of Community Health Committees (CHC) that will manage health issues in the project area cannot be over emphasized. The proposed project benefits of potable water supply and sanitation facilities will help a long way towards improving the existing public health challenges.

E5 Environmental Impacts

The project will have both positive and negative impacts as shown below:

Construction phase

Negative Impacts

- Loss of Grazing Area
- Loss of Biological diversity
- Disruption of Current Household Dynamics and Cultural Structures
- Accidents and health impacts during construction
- Rapid social and economic change due to land reallocation and scheme construction
- Dust emissions and noise

Planned and Positive impacts

- Increased employment
- Ancillary services
- Training and capacity building of communities

Operation phase
Negative Impacts

- Loss of grazing area
- Difficulties with in-field soil & water management
- Health impacts, especially with malaria and an increase in schistosomiasis
- Market constraints of vegetables and other crops
- Sugar price instability
- Challenges with regards to farmer association formation
- Possible land disputes
- Cane burning contribution to climate change
- Land acquisition and allocation during resettlement
- Possible drowning of people and livestock
- Increased risk of HIV/AIDS

Positive impacts

- Increased cropping intensity on more than 5,000 ha due to the provision of dry season irrigation water
- Access to Water Supply
- Improved livestock husbandry and productivity
- Increased and stabilised household incomes from agriculture for more than 2000 households
- Increased secondary economic activities -agriculturally-related goods and services - and associated local employment
- Improved institutional capacity of organisations responsible for water management and agricultural development
- Improved road access, with many associated benefits
- Improved gender mainstreaming initiatives
- Increased crop yields and diversity due to improved drainage, inputs and crop husbandry

E6 Resettlement Issues

Construction of the main canal will affect a total of about 22 homesteads (excluding homesteads within the irrigation blocks). Of these households, 19 will definitely be displaced and require resettlement since they fall within 100 meters of the proposed preliminary canal alignment. Some of the affected homesteads (3) are located outside the periphery of the canal, but may be affected by blasting during the construction process. The resettlement impact associated with the development of the irrigation blocks, which is still to be confirmed once detailed designs are conducted, has been adjusted to 21 homesteads. It can be noted that the area in the irrigation blocks has been reduced by 170 ha in order to prevent the resettlement of an additional 21 homesteads and to ensure that 1 ha per remaining homestead is reserved as buffer where no cane production is allowed. One (1) dip tank will be affected by the canal and one (1) basic soccer field will also have to be relocated. There are two (2) dip tanks that are located within the irrigation blocks, one (1) Umphakatsi – Mngometulu and three (3) basic soccer fields located in the irrigation blocks. Additional assessments have to be made during the detailed design phase. A total of 54 graves and one shop will also be affected by the project. Experience from the KDDP and LUSIP I shows that homesteads normally prefer to relocate not far away from the canal so to benefit from water. The project was well received by the communities especially the directly affected communities as was expressed during the scoping and validation workshops. A detailed report analysis is found in Volume 3.

E7 ESMP

The main objective of the Environmental and Social Management Plan (ESMP) is to outline measures to be taken to mitigate potential negative impacts and enhance positive impacts identified in the ESIA. The ESMP is a tool that would ensure sustainability of the mitigation of adverse impacts. Another key aspect to the compliance of the project is that of ensuring that

the mitigation measures CMP are adhered to. During preparation of the ESMP, the exact timelines of the project had not been specially determined. As such, the timelines proposed are not specific. During project detailed design phase implementation, these timelines would need to be clearly specified and agreed upon by all stakeholders involved in its implementations. Some of the measures outlined in the ESMP require the participation of stakeholders who may have different priorities and trade offs, which may affect the timelines in the implementation of those mitigation measures. The ESMP lists the predicted potential adverse impacts together with the associated mitigation costs and relevant institutional arrangements for implementation. These institutions will include; Traditional Authorities, Public sector institutions, Agricultural organizations and agribusinesses and Community-based/informal organizations. The ESMP has been developed as a separate document (Volume 1B), as outlined in the TOR.

E8 Monitoring and Management

The project will establish both compliance and effects monitoring plans. The compliance monitoring mechanisms will ensure that the various project organisations are implementing the provisions of the ESMP effectively and on time. The effects monitoring mechanisms will check on the impacts which the project is having on the physical, biological and social environment, by regular measuring of indicators. The results will be fed back to project management for evaluation.

During the project preparatory stages, the proponent (SWADE) and the financing partners would ensure that the measures outlined in the ESMP are complied with. When the construction phase commences, it is expected that a supervising consultant (Engineer) be appointed to ensure compliance of the construction contractor. The project Management Unit will prepare periodic project compliance reports to the Swaziland Environment Authority. It is also expected that there would be regular audits by the financing partner.

With respect to implementation of the Resettlement Action Plan (RAP), it is important that identification and acquisition of land is done prior to any project activity. Compensation or restoration for affected community needs to be done before any construction activity starts. Before the construction phase starts, it should be ensured that this requirement is completed satisfactorily.

- During construction, the SEA will have a role, in periodically checking ESMP implementation by reviewing the project compliance reports and routine site inspections.
- The financing partner will conduct periodic supervision missions.

E9 Institutional Arrangements

The successful and sustainability of the farms will require the establishment of new organisations and the use of existing ones required to provide agricultural and non-agricultural support services. These will be expected to provide training, agricultural inputs, services and links to markets as well as the essential non-agricultural services (water

management supplies, literacy, health etc.) -and some important project components such as livestock husbandry.

The institutional framework for the planning and implementation of LUSIP consists of the following categories of institutions:

- Traditional Authority
- Public sector institutions
- Agricultural organizations and agribusinesses
- Community-based/informal organizations

E10 Conclusions and Recommendations

The ESIA studies concluded that there are no serious environmental flaws that can prevent the implementation of the project and the significant ones can be mitigated against within the ESMP and the RAP. Subject to full resourcing and effective implementation of the measures identified in this report, the project is considered to be in compliance with the African Development Bank (AFDB) IESIA Guidelines (2003); the AFDB ESA Procedure (2001); the AFDB Gender Policy (2001); the AFDB Involuntary Resettlement Policy (2003) and The Government of Swaziland: Swaziland Environment Authority Act, 1992; The World Bank safeguard policies 4.01 Environmental Assessment, 4.04 Natural Habitats, 4.09 Pest Management, OP 4.37 Safety of Dams and 4.11 Physical Cultural Resources; Compliance with the Bank's policy on Involuntary Resettlement (OP 4.12) is the subject of the Resettlement Action Plan which was compiled in consistency with the Bank's policy and Swaziland National legislation and is a separate document, Volume 2 appendix (RAP Compliance with policy OP 7.50 Projects on International Waterways will be handled by the Ministry of Natural Resources and Energy (MNRE) through the Department of Water Affairs.

The project is an initiative to alleviate poverty through the transformation of rain-fed agricultural production systems to irrigated agriculture to improve the living standards of the rural communities in the Lowveld of the country. The prevailing living conditions are unacceptable, poverty is on the rise and the environment is under high stress from many factors such as soil erosion, over exploitation of natural resources and therefore change is imperative. There are already two projects implemented by the proponent which have yielded positive results and therefore the project is highly likely to be a success as long as the mitigation measures are taken into consideration. The project would yield greater benefits it incorporates a more diverse type of irrigated agriculture compared to the monoculture type.

The stakeholders consulted raised concerns on the issue of growing mainly sugarcane at the expense of food crops and yet there are challenges facing the agriculture sector such as climate change and food shortages. This indicates that there is a strong need for the Swaziland Government to conduct a wider Strategic Environment Assessment on agricultural development in the country and to establish stakeholder forums where such issues will be discussed at length as they are beyond the scope of this ESIA. . This need to be done to ensure that agricultural development is planned in line with other competing land

and water uses, and taking into account food security and water demand management issues.

There is need for a climate change national framework as it is difficult to implement/plan for adaptation. It is widely agreed that sugarcane will be less vulnerable to climate change due to availability of irrigation water. However, the predicted variability in precipitation and increased temperatures will affect the stream water availability resulting in high demand for water by other sectors as well thereby affecting water supply for agriculture. With the prevailing challenges of climate change, which impact on crop water requirements, there is need to investigate the commercialization of other crops, which may also be combined with the sugarcane crop, while gradually finding new opportunities for other spin-off businesses. Such an initiative would help curb situations where the sugar price has declined. Priority needs to be accorded to addressing the issue of markets and logistical constraints. Any attempts to support production diversification away from sugar without careful consideration of market and logistical components of the equation, risks jeopardising the sustainability of diversification efforts.

The livestock farmers are concerned about the co-existence of livestock and sugarcane and most of them are not willing to venture into commercial livestock farming due to a number of reasons which include low market prices and cultural values. The current numbers of livestock is also high and therefore, the project will further exacerbate the problem and will result in increased number stock over a very limited area once the sugarcane fields have been developed. Livestock commercialisation and rangeland management requires policy initiatives that would make the livestock industry to be attractive in terms of sustainability and income generation and help control overstocking problems.

The sustainability of the commercial farming in the community is highly dependent on the level of preparation and training of the farmers on business management, forming farmers associations, conflict resolutions, and cost management. Strengthening training and education initiatives not only at farmer level but also at institutions such as research organisations and the Universities is also crucial for the sustainability of these farms.

The areas that require particular attention for this proposed project include: shallow soils, issues of resettlement and compensation, population growth and food security, malaria and HIV/AIDS, conservation of threatened flora and fauna species, water quality, climate change impacts and gender mainstreaming.

LIST OF ACRONYMS

Abbreviation	Abbreviation
a.s.l.	Above sea level
CBO	Community Based Organization
CD	Community Development
CDC	Chiefdom Development Committee
CDP	Chiefdom Development Plan
CMP	Comprehensive Mitigation Plan
DWA	Department of Water Affairs
E	Emalangeni
ECC	Environmental Compliance certificate
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
FAO	Food and Agricultural Organization
GIS	Geographical Information Systems
GMOs	Genetically Modified
HBC	Home-based Caregivers
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
IFAD	International Fund for Agricultural Development
IRD	International Relief and Development
KDDP	Komati Downstream Development Project
LUSIP	Lower Usuthu Smallholder Irrigation Project
L/s	Liters per second
M	Metre
MEPD	Ministry of Economic Planning Development
MICS	Multiple Indicator Cluster Survey
MNRE	Ministry of Natural Resources and Energy
MOA	Ministry of Agriculture
MP	Member of Parliament
MTEA	Ministry of Tourism and Environmental
NAS	National Adaptation Strategy
NCP	Neighborhood Care Point
NGO	Non-government Organization
NRRP	National Rural Resettlement Policy
NSCC	National Sector Coordinating Committee
O&M	Operation and maintenance
PDA	Project Development Area
PWS	Piped Water Supply
QDCs	Quarter

RDMU	Restructuring and Diversification Management Unit
RHM	Rural Health Motivator
RHMT	Regional Health Management Team
RSSC	Royal Swaziland Sugar Association
RWSB	Rural Water Supply Branch
SEA	Swaziland Environment Authority
SEAP	Swaziland Environment Action Plan
SDC	Section Development Committee
SME	Small and Medium Enterprises
SNL	Swazi Nation Land
SNTC	Swaziland National Trust Commission
SSA	Swaziland Sugar Association
SWADE	Swaziland Water and Agricultural Development Enterprise
SWSC	Swaziland Water Services Corporation
TA	Traditional Authority
USDA	United States Department of Agriculture
UNHCR	United Nations High Commission for Refugees
UNICEF	United Nations Children's Education Fund
UNDP	United Nations Development Program
VIP	Ventilated Improved Pit
VIDP	Ventilated Improved Double Pit
WATSAN	Water and Sanitation
WSS	Water Supply and Sanitation

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1. INTRODUCTION

1.1 Background

This report is an Environmental and Social Impact Assessment (ESIA) of the LUSIP 2. It was prepared by BRLi (France) in association with SSI Engineers and Environmental Consultants (South Africa). This Report has been prepared following a request by the Client-Swaziland Water and Agriculture Development (SWADE) to the consultant to develop an Environmental and Social Impact Assessment (ESIA) and an Environmental and Social Management Plan (ESMP) for the Lower Usuthu Irrigation Project 2. The comprehensive ESIA study was prepared in accordance with World Bank standards and the Swaziland Environmental Audit, Assessment and Review Regulations, 2000. The ESIA was prepared through the involvement of national and international specialists of varying expertise and it entailed stakeholder consultations, review of relevant documents, field visits and lessons from similar projects such as the Lower Usuthu Smallholder Irrigation Project (LUSIP 1) and the Komati Downstream Development Project (KDDP).

The Lower Usuthu Smallholder Irrigation Project (LUSIP) in the south-eastern part of Swaziland, in the Lubombo Region of the Kingdom of Swaziland commenced in April 2003. The larger LUSIP project area is found in the area between Siphofaneni, Big Bend and Nsoko, chiefly on the southern side of the Usuthu area. The LUSIP 2 study area forms part of the larger LUSIP area (see the locality map in Figure 1 below).

The project involves the construction of three dams to form an off-river storage reservoir to impound 155 million cubic metres of water that will be diverted from wet season flood flows into the Lower Usuthu River for the irrigation of a total area of 11 500 ha of land. This is a phased project with phase 1 comprising an area of about 6 500 ha and phase 2 comprising about 5 000 ha.

An Environmental Impact Assessment (EIA) was prepared by Vakakis in the year 2000. The Swaziland Water and Agriculture Development Enterprise (SWADE) commissioned a few other studies in relation to the EIA which include the Comprehensive Mitigation plan for the construction phase, the Comprehensive mitigation plan for resettlement, and the Comprehensive mitigation plan for the development phase. Other studies include pre-feasibility and feasibility studies conducted by Booker Tate (1996) and GFA-Agrar (1998). In these studies a number of alternatives were considered that included: (i) low-capital-cost improvement to the existing rural system; (ii) minor irrigation alternatives; (iii) peak flow water storage alternatives; and (iv) different institutional models. Except for the third, all these options were not satisfying the development needs and they were also unsustainable on the long term as they would pose environmental risks. An analysis of alternatives to the project was conducted. Options were identified, evaluated and compared in terms of their economic and environmental costs and benefits. The no-project alternative was rejected due to low crop productivity and extensive grazing, which would result in increasing pressure on

resources leading to a decline in crop yields, reduced soil fertility and worsening gully erosion.

The LUSIP phase 2 is proposed to involve the irrigation of a further 5,750 ha of land by extending the existing phase 1 main canal South by providing additional secondary and tertiary irrigation systems as well as mobilizing the beneficiary community. Therefore Phase 2 comprise mainly of the updating of the earlier feasibility studies and preparing detailed designs and tender documents. The project also includes activities geared towards the dissemination of lessons learned and good practices such as the study validation workshops, donor conferences planned.

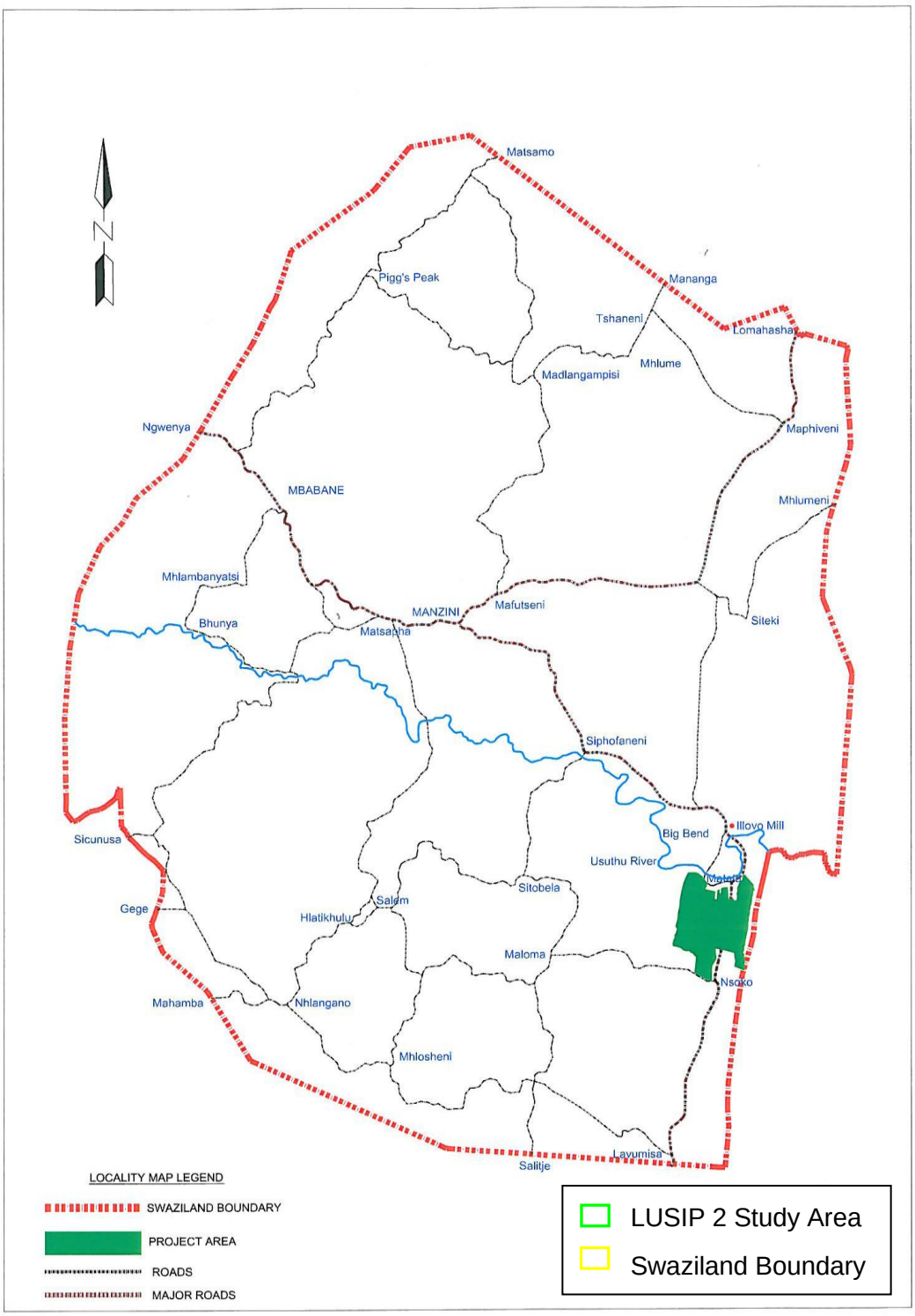

Figure 1: Location of LUSIP 2 Project Area

BRLi (France) in association with SSI (South Africa) were awarded the tender by SWADE to update the EIA that was carried out for both LUSIP 1 and LUSIP 2 in 2000 by Vakakis. This Environmental and Social Impact Assessment (ESIA) study will focus on LUSIP 2.

1.2 Project Objective

The objective of the LUSIP project is to alleviate poverty in the project area by transforming the existing subsistence farming into commercial farming of irrigated lands producing cash crops (principally sugarcane). Phase 2 is aimed at benefiting over 2000 households and is expected to bring net benefits to the rural poor of the semi-arid Lowveld of Swaziland, including: i) crop diversification for greater food security; ii) a reduced reliance on rain-fed agriculture which is prone to failure in times of droughts; iii) a reduction in water and nutrition related diseases due to the greater water supply and sanitation coverage to be provided; and iv) increased revenues per hectare cultivated due to greater yields resulting from the improved farming techniques to be introduced. The beneficiaries will be encouraged to form associations to enable them to obtain micro credits and carry out their agricultural activities efficiently. All of the land to be irrigated under LUSIP 2 is Swazi Nation Land (SNL) which is held in trust by the King on behalf of the Nation. The LUSIP 2 project will be designed based on the environmentally sound techniques to be elaborated in this study.

The Government of Swaziland has identified the development of the smallholder agricultural sector as a main element in its policy of poverty alleviation in rural areas. The major constraint for the development of resources is the lack of irrigation water, as the dry season run-of-river flows have already been fully allocated to existing farmers. LUSIP will address this constraint by creating an off-river storage reservoir that will provide irrigation water for 6500 ha at the end of Phase I and a total of 11500ha upon completion of Phase 2. Currently, the main water infrastructure for LUSIP 1 is complete and operational. About 150 homesteads have been resettled as a consequence of the infrastructure developments. More than 700 graves have been relocated, in addition to one church and one school. Chiefdom development plans established on a participatory basis with the community involved should guide further development efforts. Out of the three plans to be prepared, the Matsenjwa Development Plan has been completed.

1.3 Project Location

The Lower Usuthu Smallholder Irrigation Project Area is situated in the south-eastern part of Swaziland, in the Lubombo Region. The larger LUSIP project area is found in the area between Siphofaneni, Big Bend and Nsoko, chiefly on the southern side of the Usuthu area; the LUSIP 2 Study Area forms part of the larger LUSIP area, see the locality map below. Figure 2 shows the location of the project.

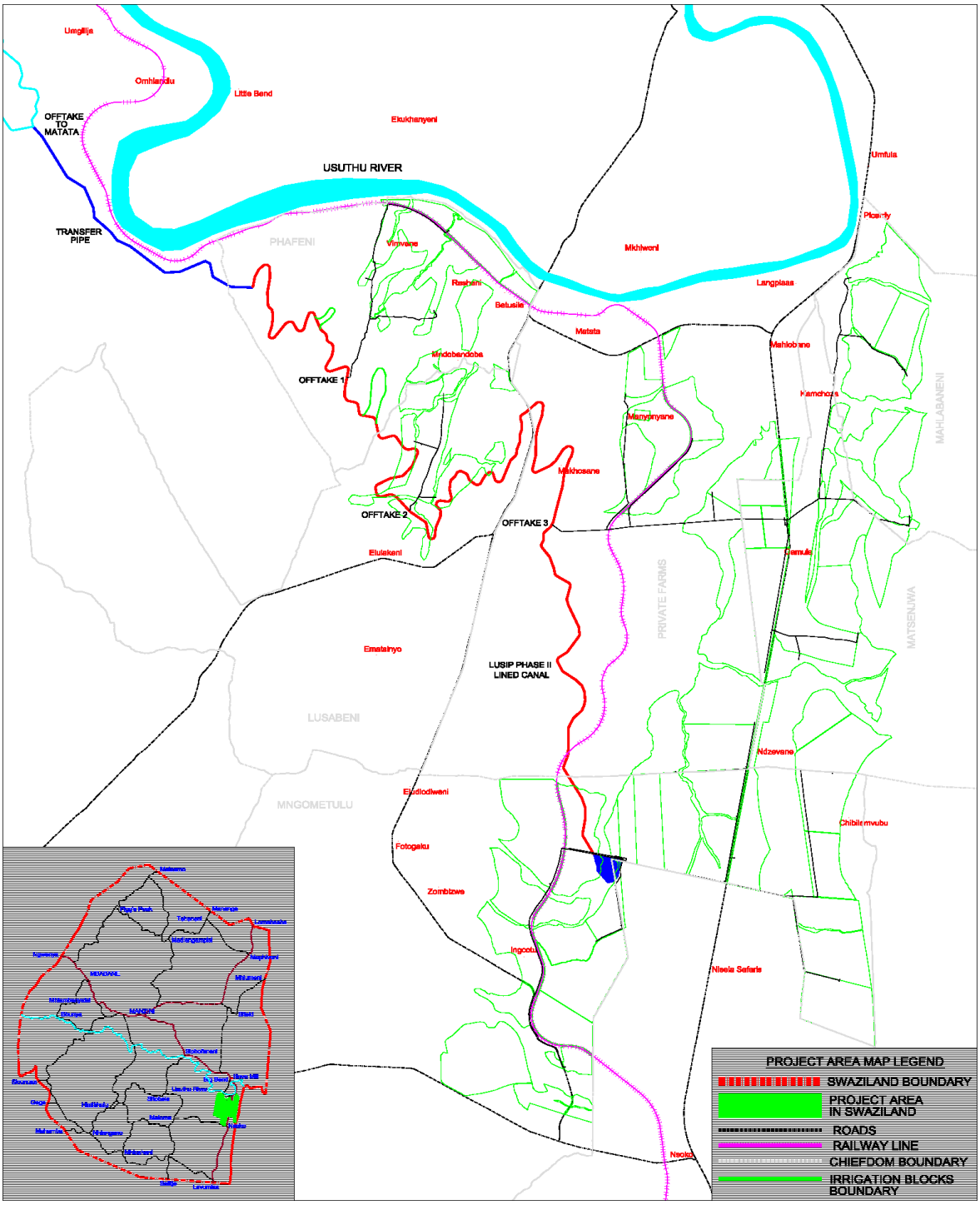

Figure 2: Locality Map

1.4 Purpose and Process of the Study

The project EIA for both phase I and phase II was conducted in the year 2000 incorporating both LUSIP Phase 1 and Phase 2. Taking cognisance of the fact that LUSIP 2 has not been implemented after 10 years of the EIA development, an update is deemed necessary. The aim is to identify gaps and changes that may have taken place between 2000 and now. Following the submission of a project brief to the SEA, the SEA categorized project as Category III (see appendix 1), which gave the proponent a go ahead to update the ESIA that was carried out by Vakakis International in 2000. The main purpose of this ESIA is to determine whether it is still environmentally, socially, technically and economically feasible to develop the site as proposed. The main objective is to identify and minimize/prevent negative potential environmental impacts whilst enhancing positive ones at planning stages to ensure sustainable development. On the basis of this category, the ESIA has been undertaken in various stages as follows:

Stage 1: *Screening and Scoping*

A project brief was submitted to the Swaziland Environment Authority (SEA) on 25 November 2011 to make SEA aware of the proposed development plan for Phase II in accordance with the requirements of the Environmental Audit, Assessment and Review Regulations of 2000. According to communication received from the SEA on 01 December 2011 this project was categorised as falling under Category 3 of the Environmental Audit, Assessment and Review Regulations of 2000. According to the Environmental Audit, Assessment and Review Regulations of 2000, and ESIA has to be conducted and terms of reference for the ESIA study has to be prepared following initial consultations with interested and affected parties and field observations. A scoping report was prepared and submitted to the Swaziland Environment Authority in January 2012. This report presented the terms of reference for the ESIA study as well as the ESIA team. It was approved as shown in Appendix 1.

Stage 2: *Environmental Impact Assessment*

This involves carrying out site investigations, evaluating negative and positive impacts, formulating comprehensive mitigation plan, to minimize adverse impacts whilst enhancing positive ones. This was conducted by various specialists to evaluate proposed project impacts and devise mitigation measures all done with project beneficiaries. The ESIA study was conducted between November 2011 and July 2012, and the result was the preparation of this ESIA report. The ESIA consultants presented the report to the proponent and the project technical committee.

A stakeholder validation workshop was held on 4 September 2012. Issues raised in the workshop were incorporated in this report. The report for the stakeholder workshop is attached as appendix 5 of the ESIA Main report (Volume 1).

Stage 3: *Public Review*

This involves advertising, acceptance of public comments and review, resubmission of revised ESIA/ESMP documents.

1.5 Scope of the Study

- Updating all the 2000 EIA report which include: overview of the project, its geographical area and the applicable legislative and institutional framework; description of the proposed LUSIP 2 project, updating the description of the project relevant components, plans, maps, figures and tables;
- Identifying the policy, legal and administrative framework relevant to the project;
- Indication of the project alternatives: Presenting and analysing alternatives to the proposed project, including the "without project" option, by identifying and comparing the alternatives on the basis of technical, economic, environmental and social criteria;
- Updating of the assessment of the potential significant environmental and social impacts of the project alternatives;
- Update the mitigation/enhancement measures to prevent, minimise, mitigate, or compensate for adverse impacts or to enhance the project environmental and social benefits, including responsibilities and associated costs.
- Addressing potential cumulative effects taking into account other initiatives planned in the study area;
- Developing an environmental and social monitoring program, including indicators, institutional responsibilities and associated costs;
- Updating the Resettlement plan (according to the AfDB rules or equivalent);
- Updating the consultations carried out with primary and secondary stakeholders in order to update their views on and preoccupations about the project.
- Updating the EIA Report into the ESIA Report.
- Preparing an Environmental and Social Management Plan (ESMP). This management plan shall be presented as a distinct document from the ESIA Report.
- Updating the Comprehensive Mitigation Plan (CMP) based in the ESMP and the climate change risk management and adaptation strategy developed.
- Contribute to Study Validation Workshops and preparation of workshop Reports.

It was agreed between the client and the consultant at Inception phase that the final product of this study will be the Draft ESIA and the ESMP reports due to time constraints.

1.6 Approach and Methodology

The comprehensive ESIA study was prepared in accordance with World Bank standards and the Swaziland Environmental Audit, Assessment and Review Regulations, 2000. This process is summarised in section 1.4.

The ESIA was prepared by the use of national and international specialists of varying expertise, stakeholder consultations, review of relevant documents, field visits and lessons from similar projects (LUSIP I and Komati Downstream Development Project).

1.6.1 Desk Review

The ESIA was prepared by the use of national and international specialists of varying expertise, stakeholder consultations, review of relevant documents, field visits and gathering lessons from similar projects (LUSIP I and Komati Downstream Development Project). The consultant reviewed the following documents as part of this review

- A detailed EIA 2000 by Vakakis International S.A.
- Institutional Analysis and Consultations with Interested and Affected Parties (IAPs);
- Analysis of Engineering Impacts of the LUSIP project;
- Hydrological Analysis of Basins and catchments;
- Socio-Economic Analysis;
- Investigation of the Vegetation of the project Area;
- Investigation of the Fauna of the project Area;
- Health Assessment of the Project Area;
- Analysis of the Livestock of the Project Area;
- Waste Analysis and Management;
- Integrated Pest Analysis and Management;
- Archaeological Investigations; Environmental Economic Analysis including Costing of the CMP and the Environmental Monitoring System.
- SWADE. 2005. Lower Usuthu Smallholder Irrigation Project. Comprehensive mitigation plan for the construction phase
- SWADE. 2006. Lower Usuthu Smallholder Irrigation Project. Comprehensive mitigation plan for resettlement.
- SWADE. 2007. Lower Usuthu Smallholder Irrigation Project. Comprehensive mitigation plan for the development phase.

1.6.2 Scoping Process (Public Consultation)

The consultant organized and convened scoping meetings for each of the 3 chiefdoms, Mngometulu, Matsenjwa and Ngcamphalala to share the project information in terms of its implementation and predicted impacts. There were also consultations made to other stakeholders and officials from Government Ministries and NGOs. Concerns that were raised by stakeholders at various stages of the study are addressed in the report. Stakeholders consulted are listed in Appendix 3 of this report.

Table 1: Summary of Issues

Issue	Approach
Loss of Grazing Area	Issue was investigated further by the livestock specialist as shown in Volume 2, Appendix 5
Loss of Biological diversity	Issue was investigated further by the ecologist as shown in Appendix 4.
Access to Water Supply	Was addressed in the Water and Sanitation component of the project.
Crop Diversity	The project design consultant as well as soil survey investigated different options for crop diversity.
Urbanization and Land Ownership	The social impact specialist investigated issues of changes in land use and land tenure and impacts these may have on the community. The gender and Human rights specialist also investigated this issue in relation to impacts to women and disadvantaged groups.
Poor Performance of Farmers Associations	The social impact specialist investigated social interactions in the community.
Resettlements and Compensation	The resettlement specialist carried out a comprehensive study to identify those that will be relocated by the project, carried out an asset survey and recommended appropriate resettlement options and compensation measures.
Impacts of Climate change to project	A climate change specialist investigated impacts of climate change on the project (Volume 2, appendix 6)
Disruption of Current Household Dynamics and Cultural Structures	The social impact specialist investigated impacts associated with relocation to the community both relocated and host communities. A Resettlement Plan was prepared and presented in Volume 3 of this Report.
Job Opportunities	The Social Baseline Study carried out a skills survey of the local population (Volume 2, Appendix 1)
Community Participation	Participation structures and approaches were presented in the social impact assessment report.
Project Costs and Profitability, sustainability.	The design consulted investigated issues of project costs and profitability and presented options in the feasibility study report.

1.7 Approach to Specialist Studies

1.7.1 Ecology Study

1.7.1.1 Flora

1.7.1.1.1 Desktop

Vegetation communities were identified prior to fieldwork using satellite imagery. Red Data plant species listed for the quarter-degree grid 2631 DD in the PRECIS database from the South African National Biodiversity Institute (SANBI), were used to produce a list of the most likely threatened species, which were searched for during fieldwork.

1.7.1.1.2 Fieldwork

Vegetation communities identified in the desktop phase were ground-truthed during field visits in February and April 2012. Representative meandering transects were surveyed on foot in each vegetation community. In order to get an assessment of relative species richness, survey quadrants (20m x 20m) were placed in areas of natural habitat. Plant species were listed per quadrant and the following cover-abundance classes were assigned to each plant species (after Kent & Coker, 1992)

Table 2: Cover-abundance Class Classification

Value	Braun-Blanquet cover
+	< 1%
1	1 – 5%
2	6 – 25%
3	26 – 50 %
4	51 – 75%
5	76 – 100%

The locations of Red Data plant species were recorded using a Garmin 60CSx GPS and these localities were used to highlight where sensitive plant assemblages occurred. Plants not identified to species level were collected and dried in a plant press for identification at a later stage.

1.7.1.2 Fauna

1.7.1.2.1 Mammals

Mammals were recorded incidentally during bird and vegetation surveys through direct observation or evidence such as spoor and droppings.

1.7.1.2.2 Birds

Birds were surveyed by slowly walking along trails through each of the vegetation types. Frequent stops were made in order to observe species that were not easily observed by walking through vegetation (e.g. skulking undergrowth species). Observations were recorded according to the Timed-Species Count method of Pomeroy & Tengecho (1986). The vocalizations of cryptic species were played on a digital recorder in order to lure those species into view and confirm occurrence. Point counts were also conducted at any significant fruit-bearing trees. Where mixed species flocks are encountered, these were followed as best as possible and all individuals noted and counted, in order to get estimation of relative frequency and abundance.

1.7.1.2.3 Reptiles & Frogs

Diurnal active searches were conducted within the different habitats present. Search techniques included visual scanning of the terrain, investigation of potential refuges (e.g. turning over logs and brushing through leaf litter) and acoustical monitoring (for frogs).

The biodiversity value of each vegetation community was based on a combination of Conservation Importance and Functional Importance, each of which were rated on a five-point scale, from Very Low to Very High. This method was based on Biodiversity Action Plan guidelines developed by Anglo American (Coombes, 2004).

1.7.1.3 Conservation Importance

The method of calculating conservation importance was based on six key parameters, which were each allocated a score that ranged between zero (Not Important) and twenty (Very Important). The overall conservation importance was based on the median value of the six parameters, namely:

1. *Protection Status*. The extent to which the vegetation community is currently formally protected (e.g. World Heritage Site; RAMSAR, National Park; Provincial Game Reserve; Private Conservancy etc);

Size. The extent to which the larger vegetation type of which the defined area is a representative sample, still exists; this incorporates the conservation status of threatened vegetation types in that vegetation types with the highest threat status are assumed to have the lowest extent of habitat remaining;

3. *Species Diversity*. The extent to which the vegetation community supports a high diversity of plants or animals;

4. *Species of Conservation Concern*. The extent to which the vegetation community supports threatened species and other species of conservation concern;

5. *Unique Habitat or Taxa*. Presence of range-restricted plants or animals or unusual natural feature (e.g. waterfall);

6. *Present Ecological State*: The extent to which the vegetation community is modified from natural conditions.

1.7.1.4 Functional Importance

The method of calculating functional importance was based on four ecosystem service categories, which were each allocated a score that ranged between zero (Not Important) and twenty (Very Important). The overall functional importance was based on the median value of the four ecosystem service categories, namely:

1. *Provisioning Services*. The extent and frequency that the vegetation community provides consumable goods (e.g. food, freshwater; timber, fibre, medicinal plants, etc);

2. *Regulating Services*. The extent to which the vegetation community provides regulating services (e.g. flood attenuation, water purification; storage, climate regulation, carbon sequestration, etc);

3. *Cultural Services*. The extent to which the vegetation community provides cultural services (e.g. tourism attraction; spiritual attraction; aesthetic value, etc), and;

4. *Supporting Services*. The extent to which the vegetation community provides supporting ecological services, either positive (e.g. migration corridor; refuge area; primary production; pollination; pest control; nutrient cycling; soil formation), or negative (e.g. disease sources; pest outbreaks).

By integrating assessments of the conservation importance and functional importance of the different vegetation communities, an assessment of Biodiversity Value was made.

1.7.2 Public Health

Baseline survey was conducted and it incorporated qualitative research approaches where open ended questions were used to guide group discussions for retrieval of information on health status of communities. Focus group discussion was conducted with representatives from each of the three Chiefdoms in the project area. Community Development Committees

(CDCs) of the chiefdoms were consulted and their views considered in the analyses of baseline health status of the communities. Self directed questionnaire was prepared and sent to key informants (Public Health Specialist) and their contributions were also key in the analyses of health impacts assessment. In addition health facility data, statistics and reports were obtained from central statistics office in Mbabane, Ministry of Health, Malaria Control Programme and Bilharzia Unit in Manzini.

1.7.3 Resettlement

1.7.3.1 Asset Survey

The objective of the asset survey was to obtain updated information on all assets affected and to determine compensation entitlements as defined in the Entitlement Framework. In particular, the following surveys were undertaken:

1.7.3.1.1 Field Survey

A survey was undertaken of all affected fields, which included: (a) fields within the 100m servitude of the Canal; and (c) all Fields affected by the reservoir to be developed at the end of the canal.

The Canal from the Main Cal South passes through grazing land utilised by the Ngcampahala and Mngometulu community, through to the private Title Deed Land (Nisela Farm).

Fields have been recorded using a GPS and then captured into the LIMS GIS system following a process of GPS data correction through control stations. A photograph was taken of each field with its homestead owner or, if the owner was not available, a substitute representative member of the community.

The location of affected fields and homesteads are shown in Map Attached for the Ngcamphalala area and, for Mngometulu area, for Matsenjwa area

1.7.3.1.2 Building and Structure Survey

This survey entailed: (a) verification of homesteads within the within canal servitude (100m); and (b) update of inventory of assets.

Each affected homestead or structure was visited and physical information recorded. The following information was collected and recorded during the survey:

- total number of buildings and size of each;
- the total area of the residential site (“footprint”);
- a field sketch of the homestead’s buildings within the foot print;

- fields utilised by each homestead, and location in relation to proposed canal;
- vegetable gardens and number of fruit trees;
- all secondary structures owned by the homestead owner, like drying lines, grinder stands, grinder shelters, kraals, pigsties, maize cribs, nest platforms, poultry shelters, tank shelters, tank stands, water ponds, water trenches, windbreaks, fences and cotton pits; and
- The number of graves associated with each homestead.

Photographs were taken of each homestead, with GPS co-ordinates taken at the centre of each homestead.

1.7.3.1.3 Survey of Affected Graves

This survey entailed: (a) identification and geo referencing of graves belonging to affected homesteads (displaced homesteads); (b) identification and geo-referencing of all other graves within the canal servitude areas.

1.7.3.2 Community Participation

A community participation process was initiated in 2000 to establish a representative community consultation and participation structure through which the people of the Lower Usuthu could participate in the planning, design, and implementation of the project.

Consultation and participation in resettlement and compensation planning has thus far occurred at homestead, sigodzi and uMphakatsi level. Individual and group/community consultation will continue during project implementation to clarify resettlement choices and compensation principles and rates, and to ensure that affected homesteads fully understand their entitlement packages.

1.7.3.3 Resettlement Options and Measures

Two broad resettlement options are being proposed: relocation within the project area; and free choice resettlement. Relocation within the project area entails relocation within the project area, either individually to a new site identified by a homestead, or as a group of homesteads to a designated resettlement site. Free choice resettlement entails resettlement to a new site identified by the homestead that is located outside both the homestead's chiefdom and the defined project area.

1.7.4 Baseline Social Survey

1.7.4.1 Quantitative Data

1.7.4.1.1 Sampling

The overall sample was 239 questionnaires divided between the three chiefdoms according to their size as gathered by the 2010 census carried out in the study area. This represents 10% of the unit of sampling which was the household.

The households to be interviewed were chosen by random sampling. Seven drop-off points were identified from which enumerators were deployed in random directions and according to unseen numbers picked at random to represent the number of households to pass before conducting each interview. The justification for random sampling is that each household should have equal probability of being selected for interview.

1.7.4.1.2 Fieldwork

Nine enumerators were recruited from the three chiefdoms on the basis of their previous experience as enumerators on the census study carried out the previous year. The enumerators attended two days of training at the LUSIP office in Big Bend where they were familiarised with the random sampling method to be used in the field, the key difference being in sampling where households were chosen at random as opposed to the all-inclusive census. A pre-test of the survey instrument was carried out at Matsenjwa on the final day of training.

1.7.4.1.3 Data-base

The data-base used for analysis was SPSS. Following data collection the questionnaires were coded for entry and a ‘codebook’ was derived from this activity to facilitate entry. This programme is accessible and allows for the running frequencies, cross-tabulations as well as the formulation of graphs and tables.

1.7.4.2 Qualitative data

A number of focus groups and key informant interviews will be carried out as part of the final baseline study to highlight the nuances of environmental and social that may not be adequately articulated by the statistics. It is envisaged that these will include: Farmers’ Associations; Cooperatives; Women’s Organisations; Youth Organisations; Herbalists / Healers; Church leaders; The Partners / stakeholders forum; LUSIP staff; Government of

Swaziland national and or regional officers (Economic Planning, Agriculture, Natural Resources, SEA, Finance)and social mapping.

1.7.5 Climate Change

Climate change scenarios were selected and then anomalies (change in the physical data) were extracted on temperature, ETP or rainfall. Using hydrological models, the impact of the change on water resources availability was determined. Changes on crop water requirements were determine by using tools, like FAO Cropwat and Climwat software and data.

1.7.6 Hydrology

1.7.6.1 Water Quality

Water Samples were collected from the following sites

Table 3: Water Sampling Points

SITE NAME	DESCRIPTION	CO-ORDINATES	
U3	Downstream of weir and silt trap releases in Usutu River	S 26° 41.859'	E 31° 35.569'
U4	Below Big Bend weir	S 26° 48.907'	E 31° 50.505'
U5	Usutu River downstream of all potential Phase 1 impacts	S 26° 50.538'	E 31° 52.575'
MP-DS	Mphapati River downstream of silt trap	S 26° 42.272'	E 31° 34.872'
ME-DS	Mhlatuzane River downstream of Lubovane Dam	S 26° 44.051'	E 31° 42.966'
M-DS	Mhlatuze River downstream of potential release from canal	S 26° 51.160'	E 31° 44.754'

The samples were taken to the laboratory and analysed according to the methods outlined in table 4.

Table 4: Methods of Analysis

Parameter / Determinant	SWSC Method	Method
pH	SOP 34	Electrometric
Nitrite	SOP 33	Colorimetric
Nitrate	AMC 02.0	Colorimetric
Phosphate	AMC 02.0	Colorimetric
Fluoride	SOP 33	Colorimetric
Sulphate	AMC 02.0	Colorimetric

Parameter / Determinant	SWSC Method	Method
Chloride	SOP 33	Colorimetric
Calcium Hardness	SOP 25	Titrimetric
Total hardness	SOP 24	Titrimetric
Conductivity	SOP 26	Potentiometric
Total Dissolved Solids	SOP 26	Potentiometric
Turbidity	SOP 21	Nephelometric
Chemical Oxygen Demand	AMC 01.0	Colorimetric
Biological Oxygen Demand	SOP 28	Respirometric
Colour	SOP 22	Colorimetric
Alkalinity	SOP 23	Titrimetric
Cations	SOP 32	ICP Quantitative Scan
Heterotrophic plate count	AMM 04.0	Pour plate
Total coliform	AMM 06.1	Defined Substrate Technology - Colisure
Faecal coliform	AMM 03.1	Membrane Filtration
Escherichia coli	AMM 06.1	Defined Substrate Technology - Colisure
Faecal streptococci	AMM 07.1	Defined Substrate Technology – Enterolert

1.8 Alternatives

The design consultant considered various project alternatives to ensure the project is economically, socially and environmentally sustainable. This focused on soils and land suitability as well as economic feasibility options for sugarcane and other crops. Different irrigation systems were also considered. This information formed the basis of the consultant's own review of alternatives. The review also includes a discussion of the 'without project' or 'no action' alternative.

1.9 ESMP

According to the World Bank, the ESMP should address the following: (*Source: adapted from World Bank Operational Policy 4.01 Environmental Assessment* (1999) *and IFC Good Practice Note:* 3 *Addressing the Social Dimensions of Private Sector Projects (2003)*

Social and Environmental Management Plan: a systematic description of the mitigation and/or sustainable development measures to be taken during project construction and operation to avoid, minimise or compensate for significant adverse impacts and enhance project benefits, plus actions to be taken to implement the measures. The Plan will cover:

• *Impact summary:* summary of significant negative and positive impacts

Mitigation and development measures: description of each mitigation and/or development measure including to which predicted impact(s) it relates how and where it will be applied

including any *Resettlement Action Plan* needed for persons *affected* by the project, developed with their participation

• *Timing:* an implementation schedule for each measure linked to the overall project timeline

Monitoring and reporting procedures: the mechanisms for compliance and *effects* monitoring, including indicators, methods and timing and feedback to management and stakeholders

Responsibilities: assignment of responsibilities for implementation, coordination, supervision, monitoring and QA/QC, enforcement, reporting, financing and staff training

Institutional strengthening requirements: description of any organizational changes and institutional strengthening required to implement the Plan

Costs and budgets: cost estimates and initial and recurrent budgets for all measures, integrated into the total project investment and operational cost tables

These aspects were used in the preparation of the ESMP.

1.10 Lessons Learnt from LUSIP I Implementation

1.10.1 Lessons from the KDDP and the LUSIP 1

The Komati Downstream Development Project (KDDP) consists of three parts: The construction of the Maguga Dam; The development of 7400 hectares of irrigated farms downstream; and The expansion of the Mhlume Sugar Mill to accommodate an additional 80 000 tonnes of sugar annually. When the project was conceived, a lot of benefits were anticipated including at least 3 000 jobs to be created, opportunities for spin-off businesses that have the capacity to generate revenue in excess of E100 million for small and medium businesses, the creation of a rural electrification supply and civil works, (access roads, bridges, pump house etc.), improved training and management skills creating opportunities for the pursuit of diverse businesses and many other benefits.

The LUSIP Project involves the construction of three dams, on the Mhlatuzane River, Golome River and a Saddle Dam, to form an off-river reservoir to store water diverted from wet season flood flows in the Usuthu River. During the first eight years, the Project will construct the dams and a distribution system, together with on-farm works, to irrigate a net irrigable area of approximately 6,500ha. The LUSIP 2 is the second phase which will involve the expansion of the water delivery system and an area of further approximately 5,000 ha to be developed. The project is envisaged to support the development of irrigated farms and create about 20 000 jobs.

SWADE was therefore established with a mandate by Government to facilitate the planning and implementation of the Komati Downstream Development Project and the Lower Usuthu Smallholder Irrigation Project, and any other large water projects that Government may

assign from time to time. SWADE plays the role of facilitator rather than manager of projects; this ensures that the affected communities control their development. Since the LUSIP 2 is planned to be implemented in a similar fashion with the KDDP and LUSIP 1. It was worthwhile to investigate the successes and challenges experienced in these projects. Though the time did not allow for a comprehensive study of the two projects but a few issues of concern were studied and they call for attention not only at just project level but at National Policy level and listed below:

1.10.2 Land Issues

1.10.2.1 Land tenure

Land is an important productive asset in agriculture and is a major factor in determining inequity in the distribution of rural income. Land tenure remains the issue of Swazi National Land and has been quoted by many as a powerful influence on the failure of Swazi farmers to expand commercial production. The existence of structural and income duality in the agricultural sector of Swaziland cannot be mitigated unless the institutional distortions on the SNL are modified to enable the subsector to take fuller advantage of the new and efficient production possibilities which are promoted by the Development Programme. The disposition of smallholders towards livestock improvements and investments in processes of agricultural capital formation can be heightened in an environment which provides prospects of long and secure tenure. SWADE alone cannot address this problem but the finalisation of the Land Policy that was put on ice many years ago can forge a solution to many of the challenges faced on SNL. Addressing this problem will work for the long-term benefit of not only the smallholders' sugarcane production, but of agricultural diversification in general.

1.10.2.2 Access to Land / Shareholding

In both the KDDP and LUSIP 1 access to land for development and other purposes follows the patrilineal lines that are set by the current land tenure system in Swaziland. The allocation is made to the male head of household / husband and not to females / women. The only females / women who have got direct access to land / shareholding are those who are widowed. Such a practice is contrary to the Constitution of the Country, National Gender Policy and locally ratified human rights instruments. Section 20 of the Constitution of Swaziland prescribes equality before and under the law and prohibits discrimination on grounds such as gender, social or economic standing, for example. Section 28 of the Constitution gives women the right to equal treatment with men and states that this right includes equal opportunities in economic and social activities. Therefore the allocation of land / shareholding along male lines marginalizes the female residents and denies them equal treatment with their male counterparts.

Article 13 of the Convention on the Elimination of all forms of Discrimination Against Women (CEDAW) to which Swaziland acceded to in 2004, provides that "States Parties shall take all

appropriate measures to eliminate discrimination against women in other areas of economic and social life in order to ensure, on a basis of equality of men and women, the same rights." Article 14(1) provides that "States Parties shall take into account the particular problems faced by rural women and the significant roles which rural women play in the economic survival of their families, including their work in the non-monetized sectors of the economy, and shall take all appropriate measures to ensure the application of the provisions of this Convention to women in rural areas and Article 14(2) provides that "States Parties shall take all appropriate measures to eliminate discrimination against women in rural areas in order to ensure, on a basis of equality of men and women, that they participate in and benefit from rural development."

On the other hand, Clause 12.4.2 of the National Gender Policy declares as a national objective "to ensure that women and girls have equitable opportunities, and access to, and control over productive and reproductive resources including credit, land, information and services." The LUSIP being a key national initiative whose overall objective is "the reduction of poverty and sustained improvement in the standard of living of the population in the Lower Usuthu Basin through commercialization and intensification of agriculture" is pivotal to the attainment of the national objective as stated in the Gender Policy.

That the allocation of land / shareholding in the farmers associations is discriminatory, not giving women equal opportunities with men as required by the national Constitution, National Gender Policy and relevant human rights instruments indicates that there is still room for improvement beginning with the Land Policy. The acquisition of land is a challenge in a number of ways; In some instances people do not have land to contribute and the Traditional Authority should be encouraged to allocate land to allow them to participate in other agricultural projects as with the example of the nursery.

1.10.3 Poverty Alleviation

The PRSAP is Swaziland's overarching policy statement for reducing poverty and other related challenges. Its main objective is to reduce poverty by more than 50% by 2015 and ultimately eradicate it by 2022. This ambitious goal, cautions that tackling poverty in Swaziland would require fundamental reforms and a change in development approach. The main objective of the KDDP and LUSIP has been poverty alleviation which is promoting rural development complemented by social and economic infrastructure. According to the 2009/2010 Swaziland Household Income and Expenditure Survey (2009/2010 SHIES), 30 percent of the population still lives in extreme poverty in the country despite the six percent poverty decline from 69 to 63 percent. The increasing incidence of poverty is in spite various resources and efforts exerted on poverty-related programmes and schemes in the country, thus suggesting that the programmes and schemes are not very effective.

Such a picture indicates that development should not just be viewed as a matter of growth in per capita income since it is possible to record a high growth rate in per capita income while the masses of the people continue to be in abject poverty and lacking in the basic necessities of life. An important objective of the projects and programmes therefore must be

to spread the benefits of economic development such that the Swazi farmers experience a marked improvement in their standard of living.

1.10.4 Access to Employment in Downstream Activities

According to the farmers under the Mabhudvu Farmers Association the KDDP has presented new opportunities for the residents and the rate of unemployment has significantly reduced because employment has opened up through the commercial activities of the Associations. However, the opportunities to the various type of employment are not equally accessible by women and men. The farmers told how jobs such as cane-cutting are mainly available to men “because this is not something for women to do.” The women are eligible for weeding and other light duties, which is easy enough for a woman. The cane-cutting job pays E120/day versus the weeding which pays only E33/day.

The project can be managed such that the youth are trained on both technical and non-technical aspects of farm management so that they are able to take up positions as Farm supervisors and clerks in the near future.

1.10.5 Access to Food and Diversification

Swaziland has experienced declining food production over the last decade resulting in a widening food disparity at the national level and increasing dependence on imports to fill production gaps. Hunger and malnutrition, which are prevalent in Swaziland, are a direct consequence of household food insecurity. The conversion of land used for maize and other crops into sugarcane production has a major impact on the availability of food to the KDDP communities especially. The ESIA team visited the KDDP and made some investigations into the successes and challenges as experienced by the farmers.

The ESIA studies also found out that the relocated families from the Malibeni area in the KDDP have experienced reduced ability to produce food for themselves and their families, due to poor access to water for irrigation. This situation they said is exacerbated by the fact that the income from Farmers Association shareholding came through only once a year. Whilst this situation affects all, its effects and burden are more severe for the women because according to the existing gender division of labour in Swazi society, women have the primary responsibility to ensure that the needs of their families are met.

From the interviews conducted in the KDDP, there seems to be a challenge in producing crops other than sugarcane due to a number of issues including marketing and finance. Nevertheless some farmers are happy with the water availability for farming while others are struggling to cope. Farmers from Mabhudvu Farmers Association and Intamakuphila Association pointed to the positive spin-off of the economic activities they were able to engage in through the availability of the water through the LUSIP. A woman farmer from the Intamakuphila Association pointed out how farming within the 35 metre buffer zone was

bringing in income at levels she had never experienced before. The main advantage was the availability of the water through the irrigation network. She is able to benefit directly because she still has access to the family fields that she had before the KDDP. This is in contrast to the women who even though participating in the sugar farming, they do so in a representative capacity and thus do not have direct access to or control over the economic benefits that accrue thereby.

The farmers interviewed indicated that they do not have enough land to produce food and therefore have to purchase food. Access to markets is part of the many huddles that these smallholders have to overcome. The problem is not just a KDDP problem but a national problem where small-scale farmers have poor infrastructure and experience barriers in penetrating the market caused by their limited resource base, lack of information, lack of or inadequate support institutions and poor policies in place among other factors. Poor infrastructure literally limits the markets to which farmers can profitably take their produce by increasing the cost of transportation, and hence also acts as a barrier to market penetration. Other barriers include market standards, limited information, requirements for large initial capital investments, limited product differentiation, and handicapping policies.

The It stands to reason that, in the interim, the agronomy and economics of a variety of crops and livestock activities including other spin-off businesses should undergo vigorous and skilled research, so that a sustainable way forward is found by the time LUSIP 2 is ready for implementation. The entry of new smallholder farmers through the KDDP and LUSIP needs to be carefully managed. Priority will need to be accorded to addressing the issue of markets and logistical constraints for the competitive supply of these markets. Any attempts to support production diversification away from sugar without careful consideration of market and logistical components of the equation, risks jeopardising the sustainability of diversification efforts.

1.10.6 Finance and Funding

Smallholder sugarcane growing is an important developmental instrument for the country; however, it is faced by many challenges including capital and operational costs. The cost of investment is a major factor in the viability of any business. It consists of the development cost and the cost of financing. The major development costs comprise of land preparation and irrigation installation. The major operational costs in the production of sugarcane include harvesting, haulage, fertilizer, electricity, and labour. These costs have risen over the years from a about E 12,000.00 per hectare in 2005 to E 22,000 per hectare in 2009. The KDDP farmers rely heavily on electricity for irrigation purposes due to pumping needs. Electricity accounts for about 17% of the total operational costs and the cost of electricity is expected to rise by 1about 25% per annum in the next years. Considering the fact that the farms are developed under 100% loans from banks, it is important that the current funding mechanism is revised to be able to realise the intended objective of poverty alleviation and for the sustainability of these farms. The Government can look into other options such grants or loans at lower interest rates.

The above situation suggests that there is a strong and urgent need for financial restructuring of both seasonal loans and capital investment loans. Financial restructuring of existing loans is essential, since without it smallholder farmers will see no personal benefit from the implementation of measures to improve yields, increase sucrose content and reduce seasonal costs.

1.10.7 Climate Change

Climate variability and change impacts in Swaziland have been felt through hydrological disasters, change in rainfall regime as well as extreme weather conditions. The ESIA team was advised that when the LUSIP was conceptualised, climate change was not considered in detail and became relevant as implementation started. It was also discovered that the country has not done much concerning climate change studies Vulnerability assessments which have been inclined towards livelihood have since been dominant in the country, driven by the donor community. Sugarcane will be less vulnerable to climate change due to irrigation but the predicted reduction in precipitation and increased temperatures will affect water availability and hereby crop production. The team could not access the second national report on climate change after the first one compiled in 2002. There is need for a climate change national framework as it is difficult to implement/plan for adaptation.

1.10.8 Implementation of Buffer Zones

In the LUSIP 1 there was a buffer zone set aside between fields and the river, however, these ended up being used for resettling relocated community members when land was not available. The team therefore recommends that the CMP needs to be as specific as possible in terms of host area identification and canal route as early as possible indicating in detail areas to be impacted negatively during implementation and Community Development Plans need to be taken into account.

1.10.9 Ecology, Archaeology and Resettlement

In LUSIP 1 a heritage site was discovered whereby the community was educated in identification. Educating the community on identification of red data species and other sites of importance is far better than establishing a nursery for conserving these species as some species cannot be relocated, but general area can be isolated. Therefore communities need to take responsibility for the preservation of species.

1.10.10 Livestock Issues

Livestock management remains an issue for attention in both the KDDP and the LUSIP 1. The projects seem to be spearheading sugarcane growing far more ahead than the livestock enterprise which is merely promoted as means of project mitigation. Livestock commercialisation as earlier on planed has not yielded great results due to a number of challenges. Water has been made available through water troughs but the rangelands are still in a state of despair and require attention by both the project and the communities. Livestock commercialisation also requires policy initiatives that would make the livestock industry to be attractive in terms of prices and those to control overstocking problems.

1.10.11 Canal Safety for Humans and Animals

The open canal system used in the LUSIP 1 poses danger to both humans and livestock. The canal requires to be fenced off and access bridges constructed at convenient locations. The designs and numbers required for the access bridges need to be taken into consideration together with the communities.

1.11 LUSIP 2 Project Challenges

1.11.1 Delays

Due to the delayed project comencement (August instead of February 2011) some of the proposed team members were nolonger available as they were committed in other projects. This therefore required replacements of members who were nolonger available and it took some time to find the right candidates and for the client to approve.

Late inclusion of Government farm and late conversion of Gangakhulu grazing area for cultivated farming meant a restarting of field work and report preparations, which then meant the study got delayed for a number of weeks.

1.12 Structure of this Report

The report is structured as follows:

Chapter 1 provides the brief introduction of the project, with study methodology.

Chapter 2 of the report presents the detailed description of the proposed project and Chapter 3 outlines the policy and administration framework.

Chapter 4 provides a description of the biophysical and socio-economic environment of the project area.

Chapter 5 presents the predicted environmental and social impacts of the project.

Chapter 6 investigates project alternatives.

Chapter 7 describes stakeholder consultation processes

Chapter 8 is a conclusion and recommendation section

Chapter 9 lists references

The Environmental and Social Management Plan (ESMP) is presented in a separate report accompanying this ESIA report, as Volume 1b.

2. PROJECT DESCRIPTION

2.1 Proposed Project Activities

The following development scenarios have been studied at the Feasibility phase of the project:

1. Base case: LUSIP2: Matata block with 5,750 ha net, Q_{peak} = 4.72 m3/s
2. Scenario 1: LUSIP2 + Poortzicht scheme (600 ha net), with a total area of 6,450 ha net, Q_{peak} = 5.29 m3/s
3. Scenario 2: LUSIP2 + 4,000ha, with a total area of 9,750 ha net, Q_{peak} = 6.72 m3/s
4. Scenario 3: LUSIP2 + 4,000ha and Poortzicht (600 ha net), with a total area of 10,450 ha net, Q_{peak} = 7.3 m3/s

The proposed bulk water supply scheme would consist of:

- a main supply system comprising 6,580 m double diam 1.8-2.0 m steel or GRP pipe and 28,187 m of concrete lined canal, at a gradient of 0.2m/km, with a capacity of 7.3 m3/s to supply 10,450 ha according to scenario 3;
- a secondary pipe network in LUSIP 2 supplying 5,750ha in irrigation blocks of 100-500 ha, including pump stations to supply water at the required pressure at the entrance of the blocks;
- increase of the capacity of the LUSIP1 bulk water supply canal (Main Canal South);
- a road network which will facilitate all weather transport and the evacuation of the produce and a drainage network, which will evacuate the excess rainfall runoff; and
- a tail-end dam with 2.5 MCM net storage capacity and supplying 2,421 ha, important buffer or regulation component, that will render water management in this upstream controlled irrigation scheme much easier and more efficient.

The proposed on-farm development systems would comprise:

- pipe systems and center pivot or semi solid sprinkler systems, if necessary pressurised by small block pump stations; and
- if preferred by developers, furrow irrigation systems provided soils and topography are suitable to achieve economically viable sugarcane farming with this type of irrigation.

2.1.1 Main Canal

The main canal is an open lined canal. It supplies water through three off takes and the outfall dam to 5,750 ha net. The longitudinal slope is 0.2m/km. The canal is normally designed taking in account the design discharge. The design discharge corresponds with the irrigation duty x area, or 0.82 l/s/ha x 5.750ha = 4.72 m^3/sec. Preliminary designs have been made using Manning's formula. Simulations with SIC have further fine tuned the design. It can be assumed that during important rainfall, farmers decide to stop irrigation. Water flowing in the main canal will then continue to the outfall dam. From here it will irrigate 2,421 ha. The dam has an important buffer capacity. It is proposed to maintain the initial capacity, from the outfall of the steel pipe down to the dam, in order to avoid spill of flows. This apparent over design has the advantage to avoid spillage of irrigation water and to allow off-peak transport of water in the future to the proposed LUSIP 3 scheme.

The hydraulic characteristics and proposed dimensions of the lined main canal up to the site for the off-take for the Poortzicht scheme are:

- Design discharge 5.29 m^3/sec
- Roughness 67 (concrete)
- Length 28,187 m
- Slope 0.2m/km
- Base width 2.10 m
- Side slope 2 :1
- Thickness concrete lining 0.10 m
- Freeboard 0.30 m

At each off take the main canal will be equipped with a duckbill weir of about 37m long and a crest level 5 cm above the downstream normal water depth. The proposed project layout is as shown in Figure 3.

2.1.2 Secondary Distribution network

The irrigation blocks will be supplied by pipe network, pressurized by both gravity and in line booster pumps, starting from four off takes, three on the main canal and one at the dam. Special attention has been given to limiting energy costs. Where possible, pipes will follow existing roads.

Table 5: Cost estimation global secondary network

Sector	Cost E
Offtake 1	7 409 086
Offtake 2	5 850 513
Offtake 3	79 715 934
Dam	94 668 765
Total	187 644 298
say	**200 000 000**

Source: LUSIP 2 Feasibility Study (2012)

2.1.3 Road and Drainage Networks

It is proposed to upgrade the road network in order to facilitate the operation and maintenance of the scheme. Roads will be provided with open ditches in order to cope with excess rainfall runoff. Six m wide gravelled roads will follow the pipe network. Unit rates have been calculated at 275 E/m. The road reserve will first be cleared on a width of 10 m, stripped at a depth of 15 cm, filled with a compacted selected material (base course), and filled with compacted gravelled material (wearing course). Total length of the pipe network is 63,426 m. Provision for an additional 10 % of length is made in order to take account with connexions to villages and other contingencies. Total length of access roads is 70.0 km at a cost of about 20 million E. Drains will follow the road alignments.

2.1.4 Pump Stations

Hydraulic modelling of the pipe network will be allowed to identify the location and design of all pipes and the preliminary designs of the in line booster pumps. The costs have been estimated with an in house diagram, relating costs of booster pumps with their capacity.

2.1.5 Irrigation Blocks

The irrigation blocks will range from about 100 ha to 500 ha sizes. Only three types of irrigation systems are favoured since they are ideally suited for beginning farmers. These are centre pivots, semi-solid sprinkler and possibly drip. Furrow irrigation, though cheaper and easy to operate is considered to be inefficient and therefore wastes much water. It could be the best option provided the tail water is recycled. A dragline system, although cheap to install, is very difficult to manage particularly to move the sprinkler with a long hose pipe. The productivity of irrigators under a dragline system is greatly reduced. Irrigators tend to cheat and not move the sprinklers. The design will be such that blocks above the main supply line will be pressurized and those below will be fed by gravity. Irrigation blocks have been subdivided for the five major areas in the three main chiefdoms. The irrigation blocks will range in area from about 100 ha to 500 ha. Each irrigation block will be subdivided into individual fields for ease of management and flexibility. This will depend on the topography of the area.

The sizes of the fields range from a minimum 11 hectares to a maximum of 230 hectares. Most of the area is under the 230 m contour except all of Lusabeni which is above the 230 m contour. Areas above the 230 m contour will create problems due to lifting of water and as the costs of electricity is escalating; it is unlikely that such areas will be included for planting. The blocking had only concentrated on the good and marginal soils. It is important to note that the final blocking should take into account the allowable distance of between 20 to 35 meters from waterways and other riparian areas and must adhere to the EIA regulations. Details of the individual chieftaincy blocks are summarised below. Blocks have been confined within chieftancy boundaries to avoid disputes. It is assumed that 5-6% of the gross area is covered by roads and structures and is hence excluded from the net irrigated area.

Table 6: Summary of the Irrigation Blocks per chiefdom

Chiefdom	**Gross area (ha)**	**Net area**
Ngcamphalala (Mahlabaneni)	681	640
Ngcamphalala (Pfafeni)	424	399
Ngcamphalala (Lusabeni)	399	375
Matsenjwa	937	881
Mngometulu	1,970	1,852
MOA Farm	1,219	1,146
Total	**5,630**	**5,293**

Source: LUSIP 2 Feasibility Report (2012)

The LUSIP2 area will have a gross area of 5,631ha and a net area of 5,293ha. Note that 574ha net are already equipped and irrigated, so the proposed on-farm development works will include 4,809ha of irrigation blocks covering new area.

2.1.6 Supply of Water for Domestic Purposes

Potable water demand has a very small impact on water demand. In the design discharge of the main supply system, this component will be neglected.

2.1.7 Tail-End Dam

The tail end dam collects water coming from both the 1,520 ha catchment area and the LUSIP 2 canal. Collected water will be used to irrigate 2,421 ha net situated in Matsenjwa (199ha) and Mngomethulu (Chiefdoms and the Government farm. The dam will be equipped with an offtake structure (tower) and a spill structure. The tower will enable to cut off the flows to the pipe network and to empty the barrage. The barrage will play an important role for the livestock.

2.1.8 Water Supply

In this activity an evaluation and management of the quantities of water needed for each component of the project (irrigated agriculture, homestead gardens, livestock water, environmental, trans-boundary/catchment and potable water supply) as well as for providing details of the institutional arrangements and the infrastructure needed for planning purposes, was undertaken. Under this component the possibility of implementing a potable water supply scheme which will consist of standpipes serving clusters of homesteads and located within 200m of these was carried out. The water will be obtained from irrigation pipelines and treated using slow sand filters or any other efficient method to be determined.

The objective for the potable water supply is improved drinking water supply and will involve;

- Rehabilitation and/or extension of 3 existing piped schemes (operational or not) in three Chiefdoms
- Construction of 3 new pipes schemes in two Chiefdoms (Phafeni and Mahlabaneni sections of Ngcamphalala and one in Mngometulu)
- Supply of all the existing and future schemes with water from the LUSIP II irrigation canal. Installation of slow sand filter water treatment plant for all water supply schemes, in order to purify water from the irrigation canal.

2.1.9 Sanitation Facilities

Under this aspect the project proponent proposes to develop sanitation facilities which will consist of the double VIP method to be based on the use of 2 pits instead of one as is the case with the VIP latrine. There is also proposed a pilot project approach where 1 latrine will be built as a showcase in each target area. Already one toilet of this nature has been constructed and completed at Gamula in the Matsenjwa community.

The objective of the sanitation component is to support provision of improved sanitation facilities, health and hygiene awareness and practices to about 2,259 households by 2015. This will take into consideration an annual growth rate of 5% until the end of the design period in 2027 (4,946 households in 2027).

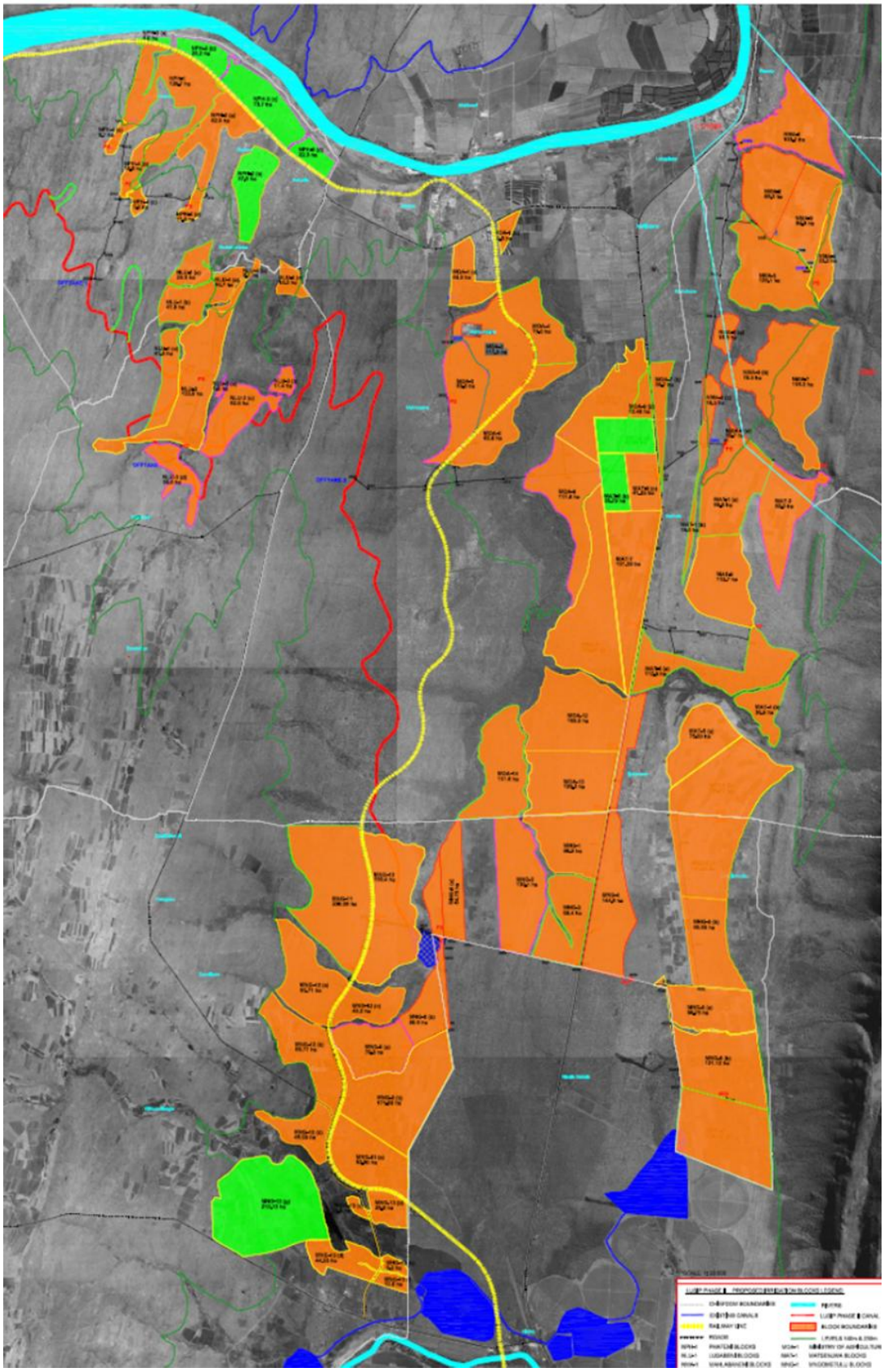

Figure 3: Project Layout

2.2 Project Costs

The feasibility was established for the project including the main and secondary water supply system for 100% sprinkler irrigation, the farming activity analyzing both 100% sugarcane and 100% mixed crops production and the provision of potable water and sanitation (WATSAN).

Total investment costs amount to about E 1.4 billion. The breakdown is presented below and is followed by the summary table with the IRRs for the cases with 100 ha and 500 ha farms

Table 7: Project Costs- Summary of investment costs Bulk Water Supply, Drainage, Development and WATSAN (million E)

Item	LUSIP 2		LUSIP 2 + 4,000	
		with PSC		with PSC
CAPACITY LUSIP 2 SIPHON&MAIN CANAL (m3/s)	**4.7**	**5.3**	**6.7**	**7.3**
INFRASTRUCTURE AND LAND DEVELOPMENT				
Main Conveyance System (MCS)				
remodeling Main Canal South	21	23	40	42
siphon, 2 pipes, 6,259m (diam 1,800-2,000mm)	180	190	220	230
lined main canal, 27,787m, Qvar, S=0.2m/km	135	142	158	161
extension to dam 400m, Qvar, S=0.2m/km	5	5	6	6
tail end reservoir				
dam	20	20	20	20
in and outlet works	8	8	8	8
spillway	3	3	3	3
sub total MCS	***372***	***391***	***455***	***470***
Secondary System (SS)				
pipelines distribution system LUSIP 2	225	225	225	225
pipeline PSC	0	31	0	31
sub total SS	***225***	***256***	***225***	***256***
Other Works (OW)				
roads system	23	23	23	23
drainage system	42	42	42	42
SCADA system	10	10	10	10
sub-total OW	***75***	***75***	***75***	***75***
On-farm development new area (5,295ha)				
roads, land prepararation, irr systems, pipes	318	318	318	318
pumpstations&electricals	80	80	80	80
powerlines and transformers	3	3	3	3
sub-total OFD	**401**	**401**	**401**	**401**
total infrastructure and land development	***1,073***	***1,123***	***1,156***	***1,202***
MISCELLANEOUS				
resettlement	30	30	30	30
impact mitigation (cattle troughs etc)	20	20	20	20
project management and coordination, studies&training	35	35	35	35
construction supervision, 3% of I&LD costs	32	34	35	36
support to farmers and training	20	20	20	20
undefined	15	15	15	15
total miscellaneous	***152***	***154***	***155***	***156***
TOTAL I&LD	***1,225***	***1,277***	***1,311***	***1,358***
TOTAL WATSAN	***43***	***43***	***43***	***43***
GRAND TOTAL	***1,268***	***1,320***	***1,354***	***1,401***
rounded to	**1,270**	**1,320**	**1,360**	**1,400**

3. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

3.1 International Laws

The key International/regional legislation relevant to the project is the SADC Shared Watercourse Systems Protocol (an Intergovernmental Water Agreement). The main thrust of the protocol, which is a legally binding document, is to ensure efficient conservation of the scarce resources and equitable sharing of water. The Usuthu River is a shared river basin between South Africa, Swaziland and Mozambique, therefore compliance with the Interim IncoMaputo Agreement (2002). Furthermore, as the project will be partly financed by loans from the African Development Bank and the European Union, it must also comply with the Bank's Environmental Policy and Environmental Sectoral Guidelines for Irrigation Development and the European Union's Environmental Guidelines.

3.1.1 African Development Bank's Requirements

In addition to considering the national policy and legal requirements, the project will be developed in line with AfDB's environmental and social requirements, specifically the following:

- African Development Bank Policy on the Environment (February 2004)
- Handbook on Stakeholder Consultation and Participation in AfDB Operations (July 2009)
- Involuntary Resettlement Policy (November 2003)
- Information Note on the Checklist for Mainstreaming Gender and Climate Change in Projects (April 2010)
- Bank Group Policy on Poverty Reduction (February 2004)
- The Gender Policy (June 2001)
- Policy for Integrated Water Resources Management (April 2000)
- The World Bank Safeguard policies 4.01;
- Environmental Assessment, 4.04;
- Natural Habitats, 4.09;
- Pest Management, OP 4.37;
- Safety of Dams and 4.11;

3.2 National Laws and Policies

The LUSIP project would comply with Swaziland's national environmental management policies and legislation. It will be guided by the Swaziland National Development Strategy (1997); National Adaptation Strategy (NAS) 2006; Poverty Reduction Strategy and Action

Plan (2007 and the results of the Strategic Environmental Assessment conducted in 2010. The relevant Acts, Regulations and Guidelines include The Kingdom of Swaziland Constitution Act No 1/2005; the Environmental Management Act 2002; the Environmental Audit, Assessment and Review Regulations of 2000; the Water and Natural Resources Act 25 of 1968 and Act 71 of 1951; the Water Act 2003; the National Trust Commission Act 9 of 1972; the Flora Protection Act of 1958; the Forests Preservation Act 28 of 1910; the Livestock Development Policy of 1995; waste regulations 2000; Water pollution control regulations 2010; Occupational Health and Safety Act 2001; Bio-Safety Policy 2011; Resettlement Policy 2003 and the Public Health Act 5 of 1969.

3.2.1 The Kingdom of Swaziland Constitution Act No 1/2005

This is the supreme law in Swaziland. Section 210 (2) provides that the state shall protect and make rational use of its land, mineral, water resources as well as its fauna and flora, and shall take appropriate measure to conserve and improve the environment for the present and future generation.

3.2.2 Environment Management Act, 2002

The act is intended to provide and promote the enhancement, protection and conservation of the environment and the sustainable management of natural resources. It also turned the Swaziland Environment Authority (SEA) into a body corporate and established the National Environment Fund. In terms of the Act, the SEA has the power to halt any and all developments that have not been adequately scrutinized for their environmental impact. Any policy, bill, regulation, program or plan requires a Strategic Environment Assessment. The Act provides for public participation, and sets out regulations for the registering of environmental information, requests for environmental information, public review, public hearings, findings of public hearings, public participation in licensing decisions, order and prosecutions initiated by the public, civil actions and other regulations. The Act is the supreme environmental law and the implementation of any non-environmental piece of legislation, e.g. the Roads Act, where it is considered to have a direct or indirect environmental impact falls under the provision of the Environmental Management Act.

3.2.3 Environmental Audit, Assessment and Review Regulations of 2000

These regulations outline processes and criteria for project screening, categorization and public participation for new projects. It spells out the requirement for environmental audits for operations that are cause for concern for the SEA. The process and formats for compilation of environmental audits, Environmental Assessments and Comprehensive Mitigation Plans (CMPs).

3.2.4 Natural Resources Act 25 of 1968 and Act 71 of 1951

A Natural Resources Board (NRB) was established by this Act. The Natural Resources Act provides for the conservation and improvement of natural resources. The Act also covers matters related to health concerns and the prevention of soil erosion during landscaping and excavation of site works, protection of water sources, public streams, disposal and control of storm water, sewage and other biohazardous effluents. The NRB is empowered in terms of this Act to order the conservation of natural resources, and such orders may relate to:

- The construction and maintenance of soil conservation works.
- The preservation and protection of the source, course or banks of rivers and streams.
- The control of water including storm water.
- The control or prohibition of the burning of grass.

It is important, particularly because of the size of the project, that both the Minister responsible and the NRB pay attention to the project at the design, construction and operation phases to see to it that provisions of the Act are not violated.

3.2.5 The Water Act 2003

This Act seeks to harmonize the management of water resources in the country. Its provisions include the establishment of a National Water Authority and of a Water Resources Master Plan. This plan will contain an inventory of the total water resources of Swaziland, and a comprehensive programme of action in which the maximum value can be obtained from this resource for the benefit of the people of Swaziland.

3.2.6 Swaziland National Trust Commission Act, 1972

This Act provides for the operation of cultural institutions and the proclamation of national parks, monuments and related matters. This Act grants the National Trust Commission powers to proclaim national parks and monuments. It can acquire or alienate movable and immovable property subject to this Act with the approval of the Deputy Prime Minister. Section 25 states that " The Minister may make recommendations in the national interest to proclaim: as a national monument, any area of land having a distinctive or beautiful scenery or geological formation, or any area of land containing rare or distinctive or beautiful flora or fauna or any area of land containing objects of archaeological, historical, or scientific interest or valley or any waterfall, cave, grotto, avenue of trees, old building, or another place or object whether natural or constructed by man of aesthetic, historical, archaeological, sacred, or religious value or interest."

3.2.7 Flora Protection Act, 2001

This Act promotes the conservation and protection of certain plants, through the use of a Schedule, trees, shrubs and vegetation and any living or dead portion of plants from destruction. If any protected flora exists in the project area and is likely to be cut or uprooted, this requires a permit from the Ministry of Agriculture (MOA). Very few protected plants or trees will be affected by the IP, and every measure should be undertaken to protect these plants if possible.

3.2.8 The Forests Preservation Act, 1910

This Act protects indigenous timber land. The Minister of Agriculture has to grant permission for clearing and cultivating any government or Swazi National Land within 30 yards of an area in which indigenous vegetation is growing. Thus any person who recklessly sets fire to any indigenous or brushwood is deemed to be guilty of an offence.

3.2.9 Livestock Development Policy of 1995

The country's Livestock Development Policy calls for the commercialisation of livestock development through the promotion of smallholder livestock production enterprises, introduction of cost- recovery programmes (removal of subsidies), promotion and marketing of produce and capacity building through training and research (MOA, 1995). The overall goal is to promote sustainable use and improvement of farm animal genetic resources to increase livestock production and productivity, ensure food security at household and national levels and improve living conditions of the rural population.

3.2.10 Waste regulations 2000

These regulate the management of all types of waste in Swaziland. They outline the functions of the Swaziland Environment Authority and local authorities. They outline provisions for the storage, collection and Disposal of waste in urban areas as well as in waste control areas (in non-urban areas). Outline requirements for carriage, and general management of waste as well as obligation for different types of wastes.

3.2.11 Water pollution control regulations 2010

These regulations control discharges made into water bodies. They outline responsibilities for operators, water authorities and the Swaziland Environment Authority in water pollution control. They provide water quality objectives as well as effluent standards.

3.2.12 Occupational Health and Safety Act 2001

The Act outlines the responsibilities of employer, employee and the government in occupational health and safety issues. It establishes a tripartite advisory committee to advise the ministry of Labour on these issues. Occupational health and safety is not the sole responsibility of the employer. The employees through the health and safety committee should also contribute toward application of the occupational health and safety standards

3.2.13 Bio-Safety Policy 2011

The policy seeks to provide a supportive and an enabling environment for the introductions of GMOs in Swaziland.

3.2.14 Resettlement Policy 2003

The guiding vision of the National Rural Resettlement Policy (NRRP), which has been approved in 2003, is to establish a durable, practical and participatory framework for the planning and sustainable management of land, and the appropriate application of resettlement strategies in rural Swaziland, in order to increase agricultural production, promote the sustainable utilisation of natural resources and improve livelihoods.

3.2.15 The Public Health Act, 1969

Swaziland Public Health concerns, and ways of dealing with them, have been expressed in the principal legislation: the Public Health Act 5 of 1969. The Act defines the Authority for prescribing and enforcing preventative and remedial measures for the protection of Public Health in Swaziland. However in recent years there has been increasing concern expressed by the environmental health officials, health officers and others that the Act fails to provide the back-up required to control risks to Public Health, and that it fails to meet the present day environmental health needs.

3.2.16 Game Act

This act seeks to regulate the protection of game. It prohibits hunting protected and royal game and animals within protected areas. The act also contains schedules that list specially protected game as well as royal game. It is administered by the King's Office.

3.2.17 Protection of Fresh Water Fish Act No.75/1936

This Act, under the Ministry of Agriculture, provides protection to indigenous species of fish by stipulating a close season during which time fishing is not permitted and also by prohibiting the capture of fish by certain destructive means. The Act prohibits the stocking or removal, cultivation, recreational fishing or dealing in fresh water fish without a permit. It provides for open and close seasons for catchments of fish and specific devices to catch fish in a sustainable manner. The Act further regulates the introduction of alien fish into the country's water bodies.

4. DESCRIPTION OF THE PROJECT ENVIRONMENT

4.1 Introduction

The LUSIP 2 project area is situated south of the Usuthu River. The area extends south to the Nsoko and the Ngwavuma River, which forms the southern boundary, and lies adjacent to the Nisela Game Reserve. It covers communities under three chiefdoms; Ngcamphalala, Matsenjwa and Mngometulu Chiefdoms.

4.2 The Physical Environment

The LUSIP 2 project area falls within the Eastern Lowveld zone, and is generally characterised by a gently undulating plain on basalt geology. The western part consists largely of rolling land in a North-South elongated ridge and valley pattern. The eastern part with foot slopes of the Lubombo Mountain range forms a typically undulating to gently undulating pediment landscape, with some interruptions by low ridges. Four Eastern Lowveld physiographic units are distinguished within the study area. The western half of the project area is defined as plain, mainly rolling (10-15% slope) and including small hills. Within the western half and within unit LE11 two small elongated units E 12 occur, defined as gently undulating (2-5% slope) areas within the overall rolling unit E11; these areas occur as distinct valleys between ridges. The eastern half of the project area is defined as plain, gently undulating (2-5% slope). A small portion in the south-eastern corner (Nsoko area) is also gently undulating.

Natural erosion can be observed in valleys and on the steeper slopes and seems to be quite stable. Most of the lower slopes are generally more eroded than the middle slopes, evidenced by a thicker weathering and soil mantle on middle slopes. This pattern suggests that a recent erosion phase is active and responsible for a certain degree of rejuvenation of the landscape. Not only are lower slopes often shallower than slopes in middle position, but also downstream river valleys are deeper incised than the upstream reaches. This can be observed in the valleys of tributaries to the Usuthu River, such as the Mfulangwenya and Mantimansundvu rivers, as well as the Mkiwa River flowing into the Ngwavuma River.

Moderate gully and sheet erosion is found mainly on the eastern pediment slopes, in particular in places where arable farming has been abandoned and replaced by communal grazing. Areas which are still cultivated are in general less affected by erosion compared to grazing land.

4.3 Geology

The overall geology of the LUSIP Project Area is characterised by the formations of the Karroo supergroup, consisting of Ecca claystones (or shales) and sandstones, Nkondolo (or

Cave) mature fluvial and aeolian sandstones, and the Sabie River (or Stormberg) series basalts, as well as by dolerite intrusions from a somewhat later date (Geological Map of Swaziland, GOS, 1982). Stratigraphically the Nkondolo sandstones fit in between the older Ecca series and the younger Sabie River basalts. The Karroo deposits are of Permian, Triassic and Jurassic age (in the order of 280-180 million years).

The sandstones (with transitions to siltstones and claystones) and shales belong to the sedimentary rock type, the basalt and dolerites to the igneous rock type (solidified from molten rock). The basalts have formed as large sheets covering the older sediments, the dolerites as small intrusions that have locally cut through older formations (here predominantly the Ecca sediments). These rock types have a variable chemical and mineralogical composition, which has led to differential weathering and erosion and consequently also to a different composition of weathering materials and resulting soils in the larger LUSIP area.

With respect to the LUSIP 2 study area, the entire area falls within the zone of basalt rock. The geology always has a profound impact on the development of the landscape and soils, but within the study area this has not led to soils differentiation as a result of the occurrence of different rock types. Physiographic differences that can be observed may be the result of minor variations in the composition and structure of the basalts; however it is more likely that external factors such as tectonics, denudation processes or preferential weathering have played a major role.

Basalt rock is largely composed of plagioclase which has a relatively high Na content (Na-Ca feldspar). The Na-rich weathering products from the plagioclase play an important role in the soil formation in the area (LUSIP 2 Soil Survey Report)

4.4 Soils

Table 8 below shows the classes of soils in the LUSIP 2 project area.

Table 8: Soil Classes in the Project Area

Set	Short Characterization Swaziland Soil Classification as given by Murdoch	Main series in LUSIP study area	Main WRB Correlation
B	B set soils are defined as recent to sub-recent stratified alluvium, deep, brownish, light textured, well to somewhat excessively drained	Bushbaby (representative) Betusile	Fluvisols / Fluvic Cambisols
C	C set are defined as Lithomorphic Vertisols on basic rock, moderately deep dark reddish brown (5YR3/3) clay, imperfectly drained, frequently in between R and K sets in catena slope position	Cuba (representative) Canterbury	Vertic Cambisols / Luvisols
DL	DL set are deep to very deep imperfectly drained yellowish brown clayey soils with iron concretions and reduction-oxidation mottling at depth	Delcor (representative)	Ferric Luvisols
F	F set are defined as orange sandy clay with lighter top, iron concretions and soft iron pan at variable depth	Felwako (representative) Funebiso Frazer	Ferric & Pisoplinthic Luvisols / Lixisols
H	H set are defined as two-deck soils, with greyish light textured top over mottled sandy clay subsoil, poorly to imperfectly drained	Habelo (representative)	Luvic Planosols
JL	J set are deep to very deep sandy loamy sands to sandy loams with merging horizons, well to somewhat excessively drained	Jovane (representative) Jehki	Arenosols / Cambisols
K	K set are moderately deep to deep Lithomorphic Vertisols (*in situ* weathered material from basic rock), black clay, poorly drained, in both elevated and lower slope position	Kwezi (representative)	Sodic Stagnic Vertisols
L	L set are moderately deep to very deep well drained red sandy clays to clays on colluvium slopes and river terraces, with strong blocky structure	Lesibovu (representative)	Rhodic Luvisols / Lixisols
O	O set are called Lithosols by Murdoch and defined as shallow often less than 40cm, developed on acid rock with variable texture, well to somewhat excessively drained	Otandweni (representative) Orrin (representative)	Regosols / Leptosols / Luvisols
R	R set are defined as dark reddish, clayey, moderately deep to very deep, well-structured Brown Soils on basic rock	Rondspring (representative) Rathbone	Endoleptic / Haplic Luvisols (Rhodic/Chromic)
SL	SL set are defined as Lithosols, rarely 40cm to weathering parent material (basic rock), medium to heavy texture, dark coloured, well to moderately well drained	Somerling (representative) Sikhutwane Shebani	Leptosols / Regosols
U	U set are defined as land units having more than 15% rock outcrops or boulders, with	Ungabolima (representative)	Lithic / Hyperskeletic Leptosols

Set	Short Characterization Swaziland Soil Classification as given by Murdoch	Main series in LUSIP study area	Main WRB Correlation
	discontinuous soil cover, mainly on steep slopes, excessively drained		
V	V set are defined as mostly deep topomorphic Vertisols, dark coloured clay with olive drab subsoil, poorly drained in low bottom lands position	Valumgwaco (representative) Vimy	Sodic Stagnic Vertisols
W	W set are soils developed in alluvium of river terraces, very deep, brown to red sandy loam to sandy clay loam, mostly well drained.	Winn Whiterock	Haplic Luvisols / Cambisols Calcic Solonetz
X	X set are recent stratified alluvial coarse sands and gravels in floodplain, excessively drained, high flood hazard	Xulwane (representative)	Fluvisols
ZL	ZL set are defined as two-deck soils: Solodized Solonetz, grey sandy loam, abruptly overlying dark grey prismatic vertic sandy clay, over olive calcareous subsoil, poorly drained	Zwide (representative)	Solodic Planosols

Source: LUSIP 2 Soil Survey Report, 2012

Soils in the study area are generally made up of moderately steep low ridges with regular rock outcrops, very shallow soils to gently sloping moderately deep soils and deeper developed Rondspring soils with depths between 70 and 100 cm or even 150 cm. The soil colour is mostly reddish brown: the moderately deep dark reddish brown to the most well drained dark reddish brown to red soils. Along the main river valleys of the study area are gentle to very gentle sloping valley bottom and sloping to steep river banks and lower valley slopes. The majority of the soils here are deep mostly poorly drained very dark gray to black strongly cracking clay soils, which are moderately deep, moderately well to imperfectly drained dark reddish brown clayey soils. These have a high risk of flooding, very poor drainage conditions, high alkalinity, occurrence of strongly developed vertisols, and occurance of shallow and eroded slopes including steep sections.

4.5 Land Suitability

According to the Soil Survey, the results of the Agro Ecological Zone (AEZ) analysis of the investigated LUSIP 2 Study Area indicate that only about one third of the total land shows potential for irrigated agriculture with most suitable crop sugarcane, apart from vegetables. For other crops the suitability is less. Cotton also comes out as relatively favourable, due to its capacity to deal with relatively high pH, high sodium and high clay content. Maize and a group of crops with corresponding requirements come out with moderate to marginal suitability for a range of soils. Banana and citrus overall ratings show the same as maize but these crops have a larger number of restrictions because of their inability to cope with high clay contents, high pH, poor drainage and alkalinity. Summer vegetables would perform relatively well as they only require shallow to moderately deep soils. Table 9 indicates the

suitability of the LUSIP area for agriculture (LUSIP 2 Feasibility Study: Draft Final Soil Survey Report, 2012)

Table 9: Land Suitability Class Coverage (ha) for Selected Crops in LUSIP 2 Study Area

Land Suitability Class	Sugarcane	Cotton	Maize Sunflower Cowpeas Sorghum Sweet Potato	Banana Citrus	Summer Vegetables
S1 Very Suitable	474	0	0	0	474
S2 Suitable	3280	474	474	474	3280
S3 Marginally Suitable	2787	4019	3.280	3280	4696
N Non Suitable	11654	13702	14441	14441	9745
Total Area	**18195**	**18195**	**18195**	**18195**	**18195**

(Source: LUSIP 2 Feasibility Study: Draft Final Soil Survey Report, 2012)

4.6 Rainfall and Temperatures

The LUSIP 2 project area lies in the Eastern Lowveld which has a mean July winter temperatures of 17^{o}C and a mean January summer temperatures of 27^{o}C. The Eastern Lowveld has summer rains from October to March and a short dry cool winter from June to August. Maximum temperatures during the summer months are high and often exceed 35^{o}C, with absolute maxima close to 45^{o}C, especially in recent years. Average minimum temperatures during the winter months range from 4 to 10°C. Freezing point is reached occasionally in June or July, with occasional ground frosts in valley bottoms.

Average annual rainfall is 590 mm at Big Bend, with 70-80% falling during the summer months. However, annual rainfall varies greatly (300 - 1000mm) and drought occurs frequently. The average annual reference evapotranspiration (Eto) in Big Bend is high, about 2300 mm.

4.7 Drainage

The Project area is part of the Maputo River Basin which extends over three countries (South Africa, Swaziland and Mozambique) and consists of two main rivers, the Usuthu River and the Pongola River, which two rivers join at the border of South Africa and Mozambique and flow north as the Maputo River to the Indian Ocean. The majority of the study area is part of the Usuthu catchment, but the southern portion lies within the Pongola catchment. The northern part of the LUSIP 2 study area forms is drained by several tributaries to the Usuthu River, of which the Mfulangwenya and Mantimandsundvo Rivers are largest. The southern part of the study area drains to the Ngwavuma River, which flows

into the Pongola River in Mozambique, before the confluence with the Usuthu River. The Mkiwa River is the main tributary to the Ngwavuma River in the study area.

The natural flow in the Usutu River and in the Lubovane dam comes from Usutu River but also from several tributaries. The main tributaries are Mzimphofu, Mhlatuzane (direct inlet into the dam), northern tributaries (W57C basin), Mhlatuze and Nyetane. The summary of the data on these rivers is shown below

Table 10: Data on Flows in Usuthu River and Tributaries

parameters	Average yearly runoff (m^3/s)					
	Usuthu at diversion weir	Mzimphofu	Mhlatuzane	North Tributaries	Mhlatuze	Big Bend (Nyetane)
min	1.9	0.0	0.2	0.0	0.4	0.1
Q5 dry	18.8	0.4	0.4	0.5	1.2	0.6
average	57.7	1.0	1.4	1.3	2.4	1.4
Q5 wet	96.6	1.7	2.4	2.2	3.7	2.2
max	232.4	4.6	8.4	6.0	9.4	6.1

Note that the tributaries' runoffs include intermediate lateral runoffs between outlets.

4.8 Water Quality

Table 11 indicates the water quality for the Usuthu, Mhlathuze River and its tributaries.

Table 11: Water Quality Results

Sampling point			U3			U4			U5		MP-DS			ME-DS			M-DS		
Sampling date			Jul-10	Dec-10	Aug-11	Jul-10	Dec-10	Aug-11	Jul-10	Aug-11	Jul-10	Dec-10	Aug-11	Jul-10	Dec-10	Aug-11	Jul-10	Dec-10	Aug-11
Parameter	**Unit**	**Standard**																	
Total Coliform	/100ml	0	1670	15531	1500	2613	26030	2005	1616	2005	3654	19863	2710	1565	2603	2005	9208	17329	2005
Escherichia coli	/100ml		160	717	25	594	410	238	185	738	1064	908	25	168	226	150	4884	886	1652
Faecal Streptococci	/100ml	0	53			31			31	45	885			4			137		
Enterococci	/100ml							40								14			140
pH	at 25 ^{0} C	6.5-8.5	8.97	7.36	7.75	7.5	7.03	7.96	8.81	7.98	8.72	7.23	7.8	7.65	6.93	7.83	7.28	7.02	7.77
Conductivity	(µS/cm)	1800			98.71			184.5		173.1			100.8			137.2			327.8
TDS	(mg/L)			36.8	49.5		35.29	92.45		86.2		53.1	50.47		45.16	66.63		56.8	163.9
Calcium hardness	(mg/L Ca CO3)			6.998	12.1		14.119	19.242		19.889		18.312	12.14		24.691	21.042		27.687	26.404
Total Hardness	(mg/L Ca CO3)	500	24.01	15.96	25.99	25	9.86	27.95	22.15	8.73	13.98	19.95	25.98	31.77	27.54	8.45	71.13	33.01	17.98
Turbidity	(NTU)	5	16.9	139	18.1	9.83	448	9.01	16.4	9.06	9.4	79.4	21.7	16.8	82.3	1.27	6.81	93.7	17.5
TSS	(mg/L)	25	0			52		12	0	18	6			8		6	26		20
COD	(mg/L)	10	54	15	8	3	14	24	42	15	32	19	3	3	14	22	10	13	7
Nitrate	(mg/L)	10	0		1.8	0.6		0.9	1.2	0.6	0.6		0.4	0.3		0.5	1.5		0.2
Ammonia	(mg/L)	0.6	0		0	5.5		0.01	0	0	0.02		0.02	3.5		0.04	0.5		0.01
Cyanide	(mg/L)		0.005			0		0.003	0.02	0.003	0			0.003		0.003	0.007		0.01
Sulphate	(mg/L)	250	4		12	7		10	4	14	3		13	5		0	5		5
Phosphates	(mg/L)	1	1.06		0.42	0.59		1.2	0.76	1.3	1.05		0.52	0.57		0.19	0.41		0.3
Nitrite	(mg/L)	3			0			0.005		0.002	0.03		0.003			0.007			0.005
Chloride	(mg/L)		20		23	30		27.82	15	12.04	15		28	20		12.76	40		57.14
Fluoride	(mg/L)	0.7	0			0			0		0			0.05			0		

Colour	(mg/L Pt-Co)	15	8	71	14	13	74		5		7	67	16	11	42		9	19	
Alkalinity	(mg/L)		32.83	18.2	34.27	38.72	14.43		32.94		20.94	17.36	65.54	53.68	46.64		67.05	57.62	
Arsenic	(As) (mg/L)				<DL			<DL		<DL			<DL			<DL			<DL
Beryllium	(Be) (mg/L)				<DL			<DL		<DL			<DL			<DL			<DL
Cadmium	(Cd) (mg/L)	0.003			<DL			<DL		<DL			<DL			<DL			<DL
Calcium	mg/L				4.392			2.65		3.245			4.554			1.254			2.51
Chromium	mg/L				<DL			<DL		<DL			<DL			<DL			<DL
Cobalt	mg/L				<DL			<DL		<DL			<DL			<DL			<DL
Copper	mg/L				<DL			<DL		<DL			<DL			<DL			<DL
Iron	mg/L	0.3			0.134			<DL		<DL			0.133			<DL			<DL
Lead	mg/L				<DL			<DL		<DL			<DL			<DL			<DL
Magnesium	mg/L				2.667			3.689		<DL			2.715			<DL			<DL
Manganese	mg/L	0.5			<DL			<DL		<DL			<DL			<DL			<DL
Nickel	mg/L				<DL			<DL		<DL			<DL			<DL			<DL
Selenium	mg/L				<DL			<DL		<DL			<DL			<DL			<DL
Vanadium	mg/L				<DL			<DL		<DL			<DL			<DL			<DL
Zinc	mg/L				<DL			<DL		<DL			<DL			<DL			<DL

The water in the Usuthu River, Mhlathuze and other streams in the project area is contaminated with microbiological contaminants as their levels were found to be way above the standard set in the Water Pollution Control Regulations, 2010. Phosphate levels were found to be high. There were also high levels of turbidity. Sulphates were found to be slightly higher than standard for Usuthu River. There is no heavy metal contamination.

4.9 Ecology

4.9.1 Flora

Much of the project area is a complex mosaic of degraded secondary woodland / thicket, cultivation and untransformed habitat. Eight vegetation communities are evident within this project area, based on distinctive vegetation structure (grassland, woodland, thicket, etc), floristic composition (dominant and diagnostic species) and position in the landscape (mid-slopes, terrace, crest, etc). These vegetation communities are described in detail below, and it is indicated where they correlate to the communities described in Vakakis (2000a). Over 50% of the project area has already been transformed through cultivation and rural settlement, and the vegetation communities described below refer to the 45% of the study area that still has natural vegetation cover (as shown in Figure 4). A detailed flora description of the project area is found in Volume 2 Appendix 4.

4.9.1.1 Acacia xanthophloea - Panicum maximum Tall Closed Woodland

A total of 52 species (17% of the entire list) was recorded from Acacia xanthophloea – Panicum maximum Tall Closed Woodland, which is relatively low species richness compared to some of the other communities. Two conservation-important species were recorded, namely Acacia xanthophloea and Spirostachys africana. Both are protected under Schedule B of the Flora Protection Act (No.10 of 2000), and have been allocated the status of Vulnerable. Cordia species A (sensu Boon, 2010) was recorded in this community, representing the first records of this species in Swaziland (Loffler & Loffler, 2005).

4.9.1.2 Ficus sycomorus-Trichilia emetica Tall Closed Woodland

This vegetation community is confined to deep alluvial soils on banks of perennial rivers, particularly the Usuthu River. It is a linear and fragmented community, covering 191 ha which equates to 0.9% of the area surveyed. Rock cover is very low. A total of 48 species (16% of the entire list) was recorded from *Ficus sycomorus – Trichilia emetica* Tall Closed Woodland, which is relatively low species richness compared to some of the other communities. Three conservation-important species were recorded. Two of these are protected under Schedule B of the Flora Protection Act (No.10 of 2001) and have been

allocated the status of Vulnerable (*Acacia xanthophloea, Breonadia salicina*) and one is protected under Schedule C and is classified as Rare (*Trichilia emetica*).

4.9.1.3 Schotia brachypetala-Croton menyhartii Thicket

Schotia brachypetala – Spirostachys africana Thicket occurs in mostly in the north-western part of the study area, associated with alluvial soils on the banks of ephemeral and non-perennial tributaries of the Usuthu River and does not appear to be associated with perennial drainage systems. The vegetation community covers 362 ha which equates to 1.4% of the area surveyed. Rock cover is very low. A total of 48 species (15.8% of the entire list) was recorded from *Schotia brachypetala – Spirostachys africana Thicket*. Median species richness in the four 400m² quadrats was 22.5 species. Species fidelity, which is closely linked to community uniqueness, is fairly high, with 16 species (33% of the community list) occurring nowhere else in the study area.

Two conservation-important species were recorded, namely *Spirostachys africana* and *Balanites pedicellaris*, both of which are protected under Schedule B of the Flora Protection Act (No.10 of 2001), and both of which have been allocated the status of Vulnerable. *Euphorbia grandicornis,* which is endemic to the Maputaland Centre of Plant Endemism (Van Wyk, 1994), was recorded in this community.

4.9.1.4 Acacia nigrescens - Sclerocarya birrea Tall Open Woodland

Acacia nigrescens – Sclerocarya birrea Tall Open Woodland is widespread throughout the study area, typically associated with plains, but also found on footslopes and midslopes. The vegetation community covers 7213 ha which equates to 28% of the area surveyed. Rock cover is mostly low, although moderate on midslopes. A total of 114 species (37.5% of the entire list) was recorded from *Acacia nigrescens – Sclerocarya birrea* Tall Open Woodland, which is the highest total for any vegetation community in the study area. Seven conservation-important species were recorded in this community.

Three species are protected under Schedule A of the Flora Protection Act (No.10 of 2001), and have been allocated the status of Endangered (*Bolusanthus speciosus, Adenium multiflorum, Boophone disticha*); all three species are confined to this community within the study area. Two species are protected under Schedule B and are classified as Vulnerable (*Huernia hystrix, Crinum cf. macowanii*), while two others are protected under Schedule C and are classified as Rare (*Aloe marlothii, Boscia albitrunca*). *Ecbolium glabratum, Ozoroa engleri* and *Acacia swazica* are three species that are endemic to the Maputaland Centre of Plant Endemism (Van Wyk, 1994) that were recorded in this community.

4.9.1.5 Acacia luedertzii - Euclea divinorum Low Closed Woodland

Acacia luederitzii – Euclea divinorum Low Closed Woodland is a fragmented community restricted to clay-rich, duplex soils the study area, occurring mostly on level areas close to drainage lines. The vegetation community covers 1090 ha which equates to 5.1% of the area surveyed. Rock cover is low. A total of 56 species (18% of the entire list) was recorded from Acacia luederitzii – Euclea divinorum Low Closed Woodland, which is most likely much lower than true species richness.

Five conservation-important species were recorded in this community. Three species are protected under Schedule B of the Flora Protection Act (No.10 of 2001), and have been allocated the status of Vulnerable (Acacia xanthophloea, Spirostachys africana, Balanites pedicellaris), and two are protected under Schedule C and are classified as Rare (Aloe parvibracteata, Sideroxylon inerme). Aloe parvibracteata is endemic to the Maputaland Centre of Plant Endemism (Van Wyk, 1994).

4.9.1.6 Acacia nilotica - Grewia flavescens Low Closed Woodland

Acacia nilotica – Grewia flavescens Low Closed Woodland is distributed on shallow to deep red clays on footslopes and midslopes .The vegetation community covers 757 ha which equates to 3.5% of the area surveyed. Rock cover is mostly low, although moderate on midslopes. A total of 74 species (28% of the entire list) was recorded from *Acacia nilotica – Grewia flavescens* Low Open Woodland, which is the third highest total for a vegetation community in the study area.

Six conservation-important species were recorded in this community. Four species are protected under Schedule B of the Flora Protection Act (No.10 of 2000), and have been allocated the status of Vulnerable (*Huernia hystrix, Stapelia gigantea, Orbea paradoxa, Barleria oxyphylla*). Two species are protected under Schedule C and are classified as Rare (*Aloe parvibracteata, Aloe marlothii*). Two of the Schedule B species have been allocated national Red Data status, having been assessed as Near Threatened (*Orbea paradoxa, Barleria oxyphylla*). *Aloe parvibracteata, Barleria oxyphylla* and *Acacia swazica* are three species that are endemic to the Maputaland Centre of Plant Endemism (Van Wyk, 1994) that were recorded in this community.

4.9.1.7 Combretum apiculatum-Aloe marlothii Low Open Woodland

Combretum apiculatum – Aloe marlothii Low Open Woodland is distributed in the project area on shallow soils on midslopes and low ridges, particularly along the eastern border (Figure 2). It is closely related to the *Acacia swazica - Aloe marlothii - Combretum apiculatum - Aristida* spp. Closed/Open Woodland mosaic of Vakakis (2000). The vegetation community covers 3593 ha which equates to 16.8% of the area surveyed. Rock cover is moderate on midslopes to fairly high on ridges. A total of 98 species (32.2% of the entire list)

was recorded from *Combretum apiculatum – Aloe marlothii* Low Open Woodland, which is the second highest total for a vegetation community in the study area.

Four conservation-important species were recorded in this community. Two species are protected under Schedule B of the Flora Protection Act (No.10 of 2001), and have been allocated the status of Vulnerable (*Ptaeroxylon obliquum, Olea europaea* subsp*. africana*). Two species are protected under Schedule C and are classified as Rare (*Boscia albitrunca, Aloe marlothii*). *Ozoroa engleri* and *Acacia swazica* are two species that are endemic to the Maputaland Centre of Plant Endemism (Van Wyk, 1994) that were recorded in this community.

4.9.1.8 Acacia nigrescens - Combretum apiculatum Low Closed Woodland

Acacia nigrescens - Combretum apiculatum Low Closed Woodland is distributed in the study area on shallow soils on upper slopes and low ridges, and is closely related to the *Combretum apiculatum – Aloe marlothii* Low Open Woodland community. The vegetation community covers 430 ha which equates to 2% of the area surveyed. Rock cover is moderate on midslopes to fairly high on ridges. A total of 63 species (24% of the entire list) was recorded from *Acacia nigrescens - Combretum apiculatum* Low Closed Woodland.

Two conservation-important species were recorded in this community, one of which is protected under Schedule B of the Flora Protection Act (No.10 of 2000), and has been allocated the status of Vulnerable (*Pachypodium saundersii*), while *Aloe marlothii* is protected under Schedule C and has been classified as Rare. *Ozoroa engleri, Euphorbia grandicornis* and *Acacia swazica* are three species that are endemic to the Maputaland Centre of Plant Endemism (Van Wyk, 1994) that were recorded in this community.

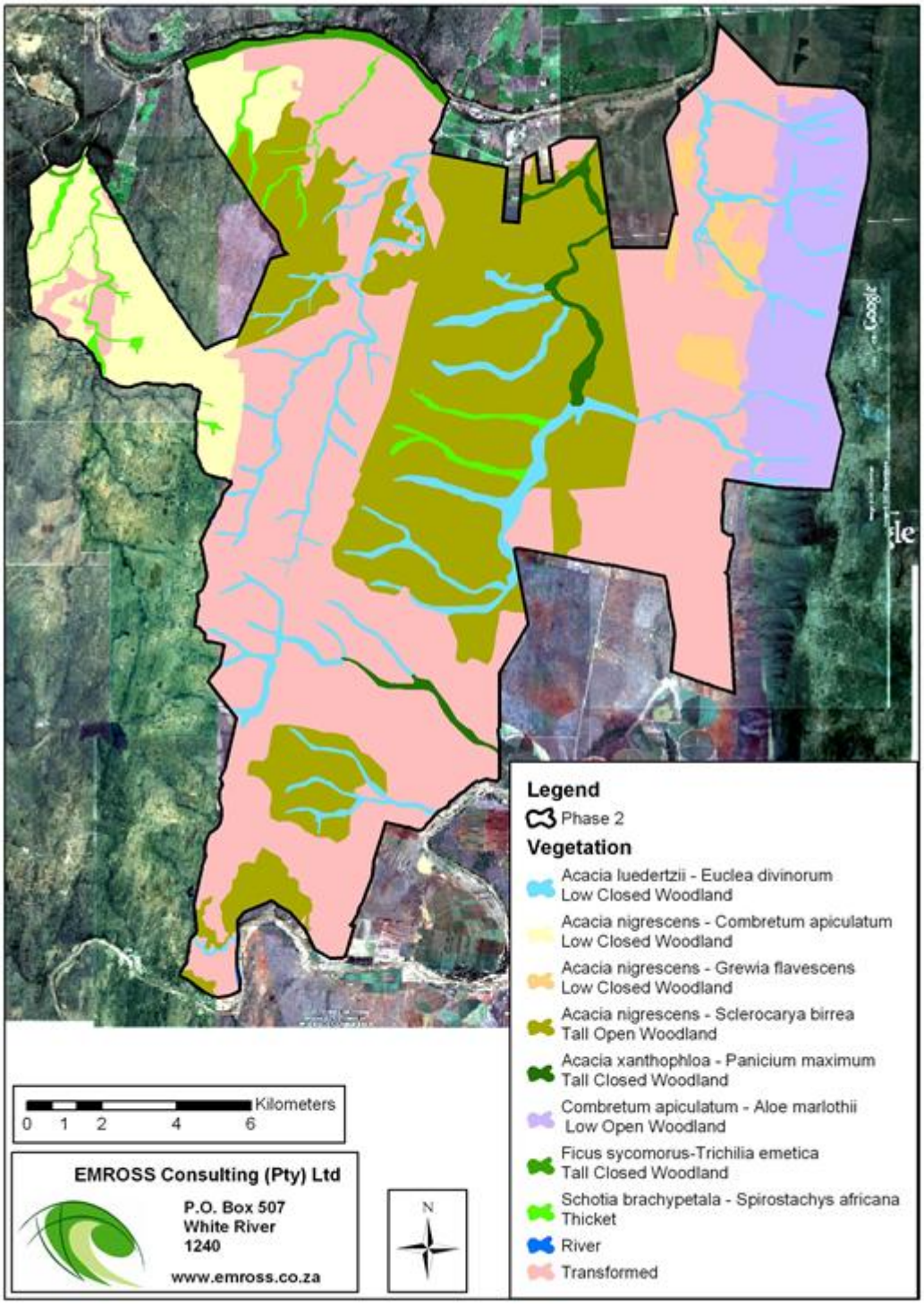

Figure 4: Vegetation Map of the LUSIP 2 Area

4.9.2 Fauna

4.9.2.1 Mammals

A total of 121 mammal species have been recorded from Swaziland, with highest species richness being recorded in the north-east and north-west of the country (Monadjem, 1998). This high species richness is attributed to the presence of protected areas in the north-east and north-west. Quarter-degree squares (QDCs) that do not contain protected areas were found by Monadjem (1998) to be positively correlated to lower mammal species richness. The LUSIP 2 project area is situated within the quarter-degree square 2631 DD, which is one of only seven QDCs that reported a mammal species richness of 46-62 species. This is most likely because of the presence of a protected area, the Nisela Private Nature Reserve, covering much of the QDC. High species richness was reported for carnivores, herbivores and rodents in 2631 DD, but low species richness for bats and insectivores. Diversity of small mammals is lowest on Swazi Nation Land, a correlation with the lack of grass cover in these areas which are often overgrazed (as shown in Figure 5).

Nine mammal species were recorded in the study area during fieldwork. While it is likely that this does reflect the low mammal species richness of the study area, particularly areas of Swazi Nation Land, no trapping of small mammals or nocturnal surveys were conducted. Small mammals and nocturnal species such as small carnivores are likely underrepresented and would be present. These species would need to be sampled through a dedicated sampling program involving live walk-in traps and camera-trapping. Vakakis (2000b) conducted such a detailed survey on adjacent land during Phase 1 of the LUSIP (although without conducting camera-trapping) and recorded a total of twenty-three mammals. This is closer to the true mammal species richness for the Phase II area, since similar habitats and disturbance regimes are present. Three of the species recorded by Vakakis (2000b) are listed in the Swaziland Red Data Book (Monadjem et al., 2003), namely Red Duiker, African Civet and Hippopotamus, which are classified as Near Threatened (duiker, civet) and Vulnerable (Hippopotamus). All three have a moderate likelihood of occurring in the Phase II area, although Hippopotamus is likely to be confined to the vicinity of the Usuthu River. A detailed fauna description of the project area is found in Volume 2 Appendix 4.

4.9.2.2 Birds

Just under 500 bird species have been recorded in Swaziland (Parker, 1994; Barnes, 1998). This high species richness reflects the diversity of habitats and steep altitudinal gradient in the country. Fifty-eight percent of these species have been recorded in the savannah ecosystems in Swaziland (Monadjem et al., 2003) in which the project area is situated. Fifty-five species are listed in the Swaziland Red Data Book (Monadjem et al., 2003), of which seven are considered regionally extinct. Sixteen Red Data species potentially occur within the LUSIP 2 project area, of which five are confirmed to occur .One of these, namely the African Hawk-Eagle has a status of Endangered. Up to 10 pairs of this species are estimated

to be resident in Swaziland (Monadjem et al., 2003), and most of the records are from the northern lowveld region. This represents the most significant faunal discovery. One Vulnerable species, the Martial Eagle, has also been confirmed to occur, but this is a wide-ranging species that could well have been passing through the project area and may not be resident. The remaining three species have a status of Near Threatened (Red-billed Oxpecker, White-backed Vulture, Yellow-billed Stork).whilst the oxpecker is likely to be resident, the other two are most likely irregular visitors from nearby conservation areas. One Endangered species (Bateleur) and one vulnerable species (Marabou Stork) were confirmed to occur just outside of the project area boundary and have a High likelihood of actually occurring within the LUSIP 2 project area.

A high total of 196 species have been recorded in the Phase II area, of which 133 have been recorded in terrestrial habitats apart from waterbirds, which were mostly recorded in the vicinity of the Usuthu River, four major terrestrial bird assemblages were identified, surveyed and summarised in the table below:

Table 12: Bird Assemblages

Assemblage	**No.Species (Sp)**	**No. conservation significant Sp.**	**No.Sp confirmed**
Acacia Plains Woodlands	93	6*	21
Degraded Plains Woodlands	49	0	5
Ridge woodland	73	8	15
Riparian Woodland & Thicket	90	6	27
Wetlands (Dams & Riverbeds)	36	1	

Assemblages show varied degrees of similarity as is shown in the table below:

Table 13: Sorensen Similarity Indices for Bird Assemblages in the LUSIP 2 Area

	Acacia Plains woodlands	**Degraded Plains woodlands**	**Ridge woodlands**	**Riparian woodland & Thicket**	**Wetlands (Dams & Riverbeds)**
Acacia Plains Woodlands	0	0.46	0.56	0.48	0.07
Degraded plains woodlands	0.46	0	0.46	0.35	0.14
Ridge woodlands	0.56	0.46	0	0.44	0.09
Riparian woodland & Thicket	0.48	0.35	0.44	0	0.19
Wetlands(Dams & Riverbeds)	0.07	0.14	0.09	0.19	0

4.9.2.3 Reptiles and Frogs

Boycott (1992) lists 109 reptiles and 44 frog species as occurring in Swaziland. Sixty-six reptile species and 31 frog species occur or have a High likelihood of occurring in the vicinity of the Project area (Lower Usuthu River Basin), based on findings of Vakakis (2000b). Fourteen species of reptiles were confirmed to occur within the Phase II area, although no frogs were recorded. Two of these reptiles have a threatened status in Swaziland (Monadjem et al., 2003) and are classified as Vulnerable (Southern African Python, Nile Crocodile). Two Near Threatened species have a Moderate likelihood of occurring because of the presence of suitable habitat and / or confirmed records nearby. Riparian habitats along large perennial watercourses are the most important habitats for the two threatened species confirmed to occur, which would include the following vegetation communities: *Acacia xanthophloa- Panicum maximum* Tall Closed Woodland, *Ficus sycomorus-Trichilia emetica* Tall Closed Woodland and *Schotia brachypetala-Croton menyhartii* Thicket.

4.9.2.4 Conservation-Important Fauna

While no Red Data mammals are confirmed to occur, According to the specialist three species have a Moderate likelihood of occurrence because of records from adjacent properties. Two of these are classified as Near Threatened (African Civet, Red Duiker) and one is Vulnerable (Hippopotamus). Riparian vegetation communities are likely to be the most

important for all three species, with the civet occurring more widely away from water and dense vegetation.

Five Red Data bird species are confirmed to occur within the Phase II project area and another two species are confirmed to occur on adjacent properties. Two of these have been assessed as Endangered (African Hawk-Eagle, Bateleur). Two species are classified as Vulnerable (Martial Eagle, Marabou Stork), of which Martial Eagle is possibly a rare breeding resident, while Marabou Stork is likely to be an irregular visitor. The remaining three species are classified as Near Threatened (Red-billed Oxpecker, White-backed Vulture, Yellow-billed Stork). Both the oxpecker and the vulture are likely to be breeding residents in the project area, the stork is most likely an irregular non-breeding visitor.

Two threatened reptiles are confirmed to occur in the project area, namely Nile Crocodile and Southern African Python, both of which are classified as Vulnerable. These species are likely to be closely linked to riparian habitats, particularly along the Usuthu River, although the python does occur across a wide range of terrestrial habitats.

4.9.3 Biodiversity Value Assessment

A qualitative integration of conservation importance and functional importance values for the different vegetation communities represented in the project area provides an indication of the biodiversity values of these communities. *Ficus sycomorus-Trichilia emetica* Tall Closed Woodland has the highest biodiversity value in the project area, and is the only community that scores High for Biodiversity Value. This is because of its potential to provide habitat for a wide range of confirmed threatened species, and for its functional importance in riparian systems. All of the other vegetation communities in the study area have Moderate Biodiversity Value, while transformed areas have Low Biodiversity Value.

Table 14: Conservation Importance, Functional Importance and Biodiversity Value Scores for Vegetation Communities in the LUSIP 2 Study Area

	Acacia xanthophloea - Panicum maximum Tall Closed Woodland	*Ficus sycomorus-Trichilia emetica* Tall Closed Woodland	*Schotia brachypetala-Croton menyhartii* Thicket	*Acacia swazica - Sclerocarya birrea* Low Open Woodland	*Acacia luedertzii - Euclea divinorum* Low Closed Woodland	*Acacia nilotica - Grewia flavescens* Low Closed Woodland	*Combretum apiculatum-Aloe marlothii* Low Open Woodland	*Acacia nigrescens - Combretum apiculatum* Low Closed Woodland
Conservation importance	moderate	high	moderate	moderate	moderate	moderate	moderate	moderate
Functional importance	moderate	moderate	low	Low	low	low	moderate	low
Biodiversity value	moderate	High	moderate	moderate	moderate	moderate	moderate	moderate

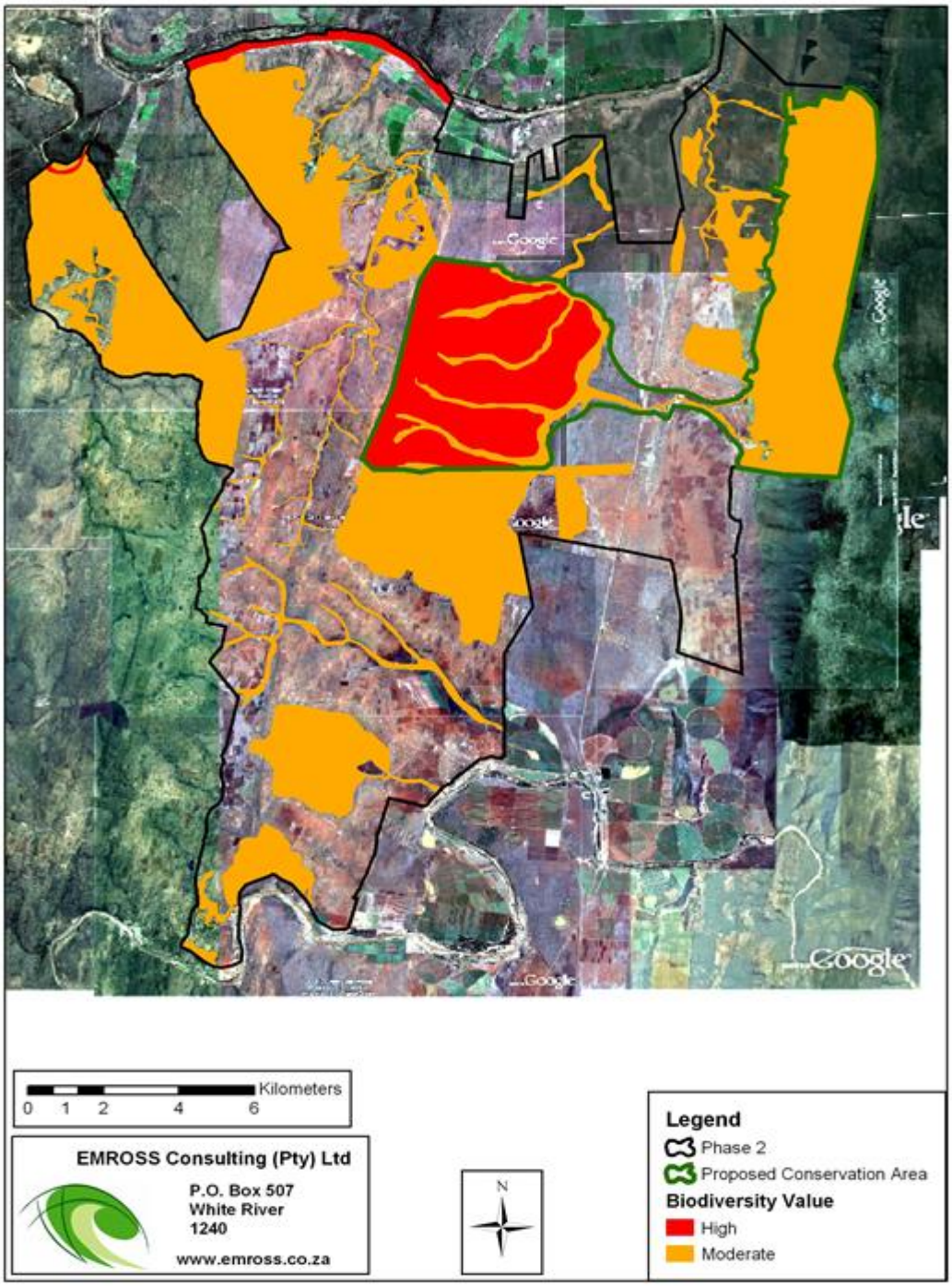

Figure 5: Biodiversity Value Map of the LUSIP 2 Area

A detailed ecology assessment specialist report is attached in Volume 2, Appendix 4.

4.10 Socio Economic Environment

4.10.1 Community Political Leadership

The dominant leadership at the project area is traditional authority (Umphakatsi), where a Chief runs the day to day affairs of the people. The Chief rule the people on behalf of His Majesty the King of Swaziland (King Mswati III) who, in conjunction with the Swaziland Government rules the country with the King at the helm. The Chief has the ultimate authority on the Swazi nation land and he allocates land to Swaziland nationals through Kukhonta (asking for land in a traditional way). The non-Swazi people can only get land (Kukhonta) through the King. The organizational structure at the chiefdom is that, the Chiefs must have Indvuna (Headman) and Bandlancane (inner council) that he works with to control and pursue the aspiration of the people under him. Under Bandlancane there is Umgigimi (chief runner) and Tibondza (local leaders) at etigodzini (sections areas). Chiefs through Headman and council direct development in the area. The Chiefs work closely with Inkhundla (Constituency) where an Indvuna Yenkhundla and Member of Parliament direct development of the Constituency. In cases of project implementation in the area a chief and his people must accept and participate in the project or else they (people and the chief) will resent it. The project area covers three chiefdoms namely: Ngcamphalala, Matsenjwa and Mngomezulu. The following table gives a summary of the institutional setting.

Table 15: Sections under Chiefs and Constituencies

Umphakatsi (chiefdom)	Tigodzi (sections)	Inkhundla
Matsenjwa	Bhobo; HHungwane; Lushikishini; Ngonini; Sicetwini; Tinhlabeni	Nkilongo
Ngcamphalala	Gobonya; Mahlabaneni; Mkhalanfene; Ludlodlo; Makhasane; Mcumaneni; Ncandvweni; Ntamakuphila; Makhulusihlenge Mayayeni; Mdobandoba.	Nkilongo
Mgometulu	Gangakhulu; Ndzevane; Lubulini; Madabukeni; Ngonini; Mabantanini I; Mabantanini II; Matjetjeni; Moyeni; Ncandvweni.	Lubulini

4.10.2 Demography

The project area is about 215 km^2 and has a population density of about 67 habitants per km^2 at average. There is, in total a population of about 14 276 occupying about 2 256 households. Matsenjwa Chiefdom has a population of about 1 864 with about 280 households, Ngcamphalala has 6365 people with 1012 households and Mngometulu has 6047 people and 967 households. The population is projected to be 19, 552 in 2022 with annual growth rate of 2.9% (Swaziland statistics). In the project area 52% of residents are

female and 48% are male. The average number of occupants in each household is 7.7 persons and ranges from 1 – 26 occupants. Local reports indicate that immigration to the PDA reached 25% during the last 5 years[3] (annual growth rate of 5% during the 5 last years) (LUSIP 2 Draft feasibility Report, Water Supply and Sanitation).The table below shows the breakdown of the population:

Table 16: Demography of LUSIP 2 PDA

Chiefdom	Sub-division	Section	Number of homesteads	Number of households	Number of people
Matsenjwa	Gamula	Bhobo	112	123	770
		Hhungwane	15	19	122
		Lushikishini	18	20	138
		Ngonini	19	21	141
		Sicelwini	89	95	673
		Tinhlabeni	2	2	20
Total			***255***	***280***	***1,864***
Ngcamphalala	Mahlababeni	Goboyane	76	88	487
		Mahlabaneni	89	102	593
		Mkhalamfene	63	76	475
	Sub-total		***228***	***266***	***1,555***
	Lusabeni	Ludlodlo	53	63	403
		Makhasane	28	39	198
		Mcumaneni	64	68	425
		Ncandvweni	88	103	765
		Ntamakuphila	71	83	491
	Sub-total		***304***	***356***	***2,282***
	Phafeni	Makhulusihlenge	99	122	785
		Mayayeni	61	66	420
		Mdobandoba	166	202	1323
	Sub-total		***326***	***390***	***2,528***
Total			***858***	***1,012***	***6,365***
Mngometulu	Ndzevane	Gangakhulu	50	53	306
		Ndzevane	136	158	1,000
	Sub-total		**186**	**211**	**1,306**
	Lubulini	Lubulini	124	149	389
		Madabukeni	61	69	981
		Ngonini	8	10	61
		Victory	100	120	786
	Sub-total		**293**	**348**	**2,217**
	Mabantaneni	Mabantanini I	26	41	273
		Mabantanini II	61	79	502
		Matjetjeni	109	141	789

Chiefdom	Sub-division	Section	Number of homesteads	Number of households	Number of people
		Moyeni	80	90	543
		Ncandvweni	47	57	417
	Sub-total		**323**	**408**	**2,524**
Total			***802***	***967***	***6,047***
Total			**1,915**	**2,259**	**14,276**

(Source: LUSIP 2 Draft feasibility Report, Water Supply and Sanitation)

4.10.3 Education

Twenty seven and two fifths percent (27.4%) of the population in the project area has never been to school. Of those who attained education, a majority went up to grade 7. There is a very small portion (1.36) of the population that attained a tertiary education (LUSIP 2 Baseline Survey Report)

4.10.4 Economic Activity

19.05% of residents are in paid employment. A further **35.3%** are currently at school. The table below sets out the types of employment residents are currently engaged in.

Table 17: Occupation of Employed Persons in the LUSIP 2 Project Area by Gender

Occupation	Total	%	Male	%	Female	%
Farm labour	365	16.1	249	16.7	116	14.9
Other labourer	290	12.8	186	12.5	104	13.4
Driver/mechanic	254	11.2	251	16.8	3	0.4
Domestic worker/gardener	255	11.2	87	5.8	168	21.6
Construction worker	185	8.2	182	12.2	3	0.4
Security (incl. police)	160	7.1	145	9.7	15	1.9
Factory worker	144	6.3	67	4.5	77	9.9
Teacher	106	4.7	37	2.5	69	8.9
Miner	91	4.0	88	5.9	3	0.4
Clerk/office worker	64	2.8	18	1.2	46	5.9
Hotel worker	36	1.6	8	0.5	28	3.6
Taxi driver	26	1.1	20	1.3	6	0.8
Commercial Farmer	23	1.0	14	0.9	9	1.2
Subsistence Farmer	23	1.0	15	1.0	8	1.0
Military	21	0.9	15	1.0	6	0.8
Nurse	18	0.8	7	0.5	11	1.4
Spaza Owner	12	0.5	4	0.3	8	1.0

Other	195	8.6	98	6.6	97	12.5
Total	**2,268**	**100**	**1,491**	**100**	**777**	**100**

(Source: LUSIP 2 Draft feasibility Report, Water Supply and Sanitation)

Only 21% of individuals are said to have an income. Income level ranges from E50 per month to E30000 per month with the majority falling in the E200 – E500 range.

A very small percentage (4.2%) of households in the project area owns a business. There are a wide variety of businesses owned by residents. 10% of businesses owned are sewing; selling dairy products; grocery shops; transport; bar / restaurants and sugarcane farming. 20% are hair salons and street vending or hawking. The number of people employed in these businesses range from 1 to 5 persons although they most frequently hire only 1person. In 6 of the businesses there are women employees.

4.10.5 Physical Infrastructure

4.10.5.1 Health Facilities

There are 5 health facility centres within the LUSIP 2 project area's vicinity which are namely the Ubombo Sugar hospital, Bholi clinic, Ndzevane Clinic, Lubulini clinic, Big-Bend Correctional Services clinic and the Ikwezi Joy clinic.

4.10.5.2 Schools

There are 19 schools within the Project Development Area (PDA) run by government, private and religious organizations as shown in table 18 below. There are also a number of pre-schools run by community and religious organizations as well as private individuals.

Table 18: Schools in the LUSIP 2 PDA

Chiefdom	Schools
Matsenjwa	5
Mngometulu	4
Ngcamphalala[1]	10
Total	**19**

Source: LUSIP 2 Draft feasibility Report, Water Supply and Sanitation, 2012

4.10.5.3 Roads

There are two main roads in the project area, both running in a north-south direction from Big Bend: MR8, an asphalt road connecting Big Bend with Lavumisa on the border to South Africa and a secondary gravel road running parallel to the MR8 connecting Big Bend with the village of Nsoko to the south. Radiating from these two roads is a network of tertiary dirt roads connecting settlements and homesteads. Where the topography is relatively flat, settlements tend to be distributed in a linear pattern along roads, and in areas where the topography is relatively hilly, settlements tend to be located in a more nucleated pattern on the sides and tops of hills (LUSIP 2 Draft feasibility Report, Water Supply and Sanitation).

4.10.5.4 Electrification

The project area has electricity as it has been shown that 49% of the households use electricity.

4.10.5.5 Telephone line

In the list of assets it has been reported that some households have fixed phones or landlines which indicates that there are telephone services within the area of the project.

4.10.5.6 Amenities

The town of Big Bend, with a population of about 10,500, serves the PDA with banking, service stations, auto repair services, restaurants, supermarkets and a club which provides recreational facilities. At Matata in the PDA there is a large complex which includes a supermarket, banks, shops, government offices, an agricultural marketing center, mechanical workshops and other facilities.

4.10.5.7 Emergency services and Police Stations

There are about six police stations within and in proximity to the LUSIP PDA which are namely Big Bend, Lubuli, Matata, Sithobela, St. Phillips and Siphofaneni. The nearest fire station is located at Siteki, which is 38 km from Big Bend.

4.10.6 Sanitation and Health

4.10.6.1 Portable Water

The stand-pipe or tap is the most common source of drinking water at 60.4%. The river is the next common source at 17.6% very closely followed by the borehole at 16.7%. A majority (70.3%) of the households have the source of their drinking water is protected. Only 43.1% of the households report the source to be constant. It takes between 1 and 120 minutes to reach this water source although the majority (74.8%) take 30 minutes or less. Children are mainly responsible for collecting drinking water. For livestock purposes; the main source of water is the river (24.7%), followed by earth dam (18%). Relatively few use water from standpipes (6.7%) or boreholes (4.6%) for this purpose. A detailed public health description of the project area is found in Volume 2 Appendix 3.

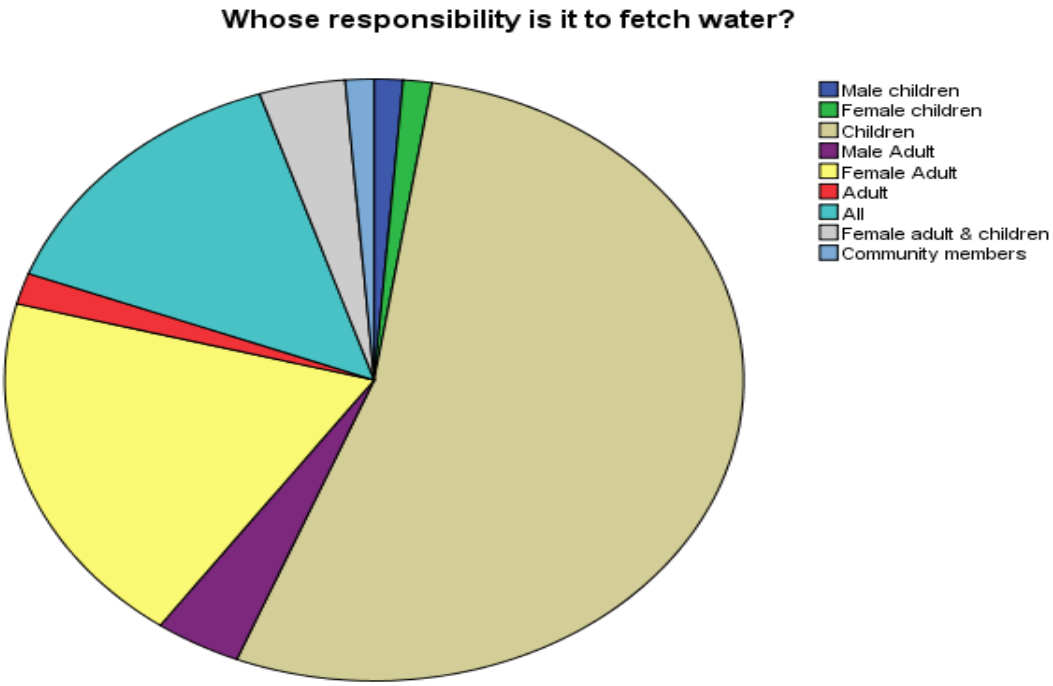

Figure 6: Responsibilities for fetching water

4.10.6.2 Latrines

61.5% of households have a latrine, **99.3%** of which are still functional. The most common type of latrines is the simple pit latrine **(60.5%)** followed by the Ventilated Pit Latrine **(39.5%).**

Pits vary between 3m to just less than 1.5m in depth with a majority being 1.5m (49%). In **75.5%** of the households who have latrines, all family members can use the pit latrine regardless of age or status. The apparent lifespan of existing latrines ranges from 1 to 60 years.

4.10.6.3 Disabilities

15.1% of the households have a member living with disability. **5.7%** of these have received external assistance. **22.9%** are said to take part in community activities including education, employment and sport

4.10.6.4 Illnesses

22.6% of the households have a member who is currently sick. **74.1%** of these have sought medical attention and **72.5%** of cases are said to be showing signs of improvement since medical attention was sought.

4.10.6.5 Prevalent Diseases

The major vector borne diseases in the project area are malaria and bilharzia. Malaria is one of endemic and most serious public-health diseases in the lowveld of Swaziland especially in the project area. Other prevalent diseases within the project area include Upper respiratory infection, muscular skeletal disease, skin disorder; acute watery diarrhoea .The table below gives a summary of the most prevalent diseases per health facility by showing number of cases that have been recorded between January and May 2012. Table19 shows the prevalence of diseases in the project area.

Table 19: Prevalence of Diseases in the Project Area

HEALTH FACILITY					
CONDITION	**Ubombo Sugar Hospital**	**Bholi Clinic**	**Ndzevane Community Clinic**	**Lubulini Clinic**	**Big-Bend Correctional Services**
Upper Respiratory Infection	1642	900	1360	1109	399
Muscular Skeletal Condition	562	122	-	116	172
Skin disorder	544	588	832	350	169
Hypertension	400	-	264	369	-
Digestive	250	146	244	71	158

HEALTH FACILITY					
CONDITION	**Ubombo Sugar Hospital**	**Bholi Clinic**	**Ndzevane Community Clinic**	**Lubulini Clinic**	**Big-Bend Correctional Services**
Disorders					
Injury	204	130	129	73	112
Eye Diseases	193	75	-	88	-
Acute Watery Diarrhoea	171	381	601	333	-
Diabetes Mellitus	172	-	-	-	-
Lower Respiratory Infection	146	287	-	166	69
Vaginal discharge	-	72	-	-	-
Other STI	-	71	147	-	47
Intestinal Worms	-	-	120	-	-

4.10.6.6 Morbidity

The morbidity rate of the LUSIP 2 area within the past year is estimated to be **7.1%.**

4.10.6.7 Social Pathologies

Social pathologies which are said to occur within the LUSIP 2 are include but are not limited to Livestock theft, house burglary, domestic violence, substance abuse and xenophobia which is however reported to be very rare.

4.10.7 Livestock

Livestock represents an important source of food and animal products as well as having cultural importance. Livestock and domestic fowl are most commonly used for consumption, income from sales and for ceremonies such as weddings and funerals. Cattle also play an important social and cultural role in Swazi society and are kept for as symbols of social status, for payment of Lobola (bride price) and as savings that can be converted to cash in case of hardship. About forty five percent (45.5%) of households reportedly do not have livestock.

The following table shows the Livestock kept in the Project area:

Table 20: Livestock Owned/Kept by Chiefdom (2011)

Livestock	Matsenjwa		Ngcamphalala		Mgomethulu		Total
	Number	%	Number	%	Number	%	
Cattle	810	11	3,404	47	3,007	42	7,221
Goats	499	6	3,477	42	4,253	52	8,229
Sheep	47	15	190	60	78	25	315
Donkeys	0	0	121	53	106	47	227

(Source: LUSIP 2 Draft feasibility Report, Water Supply and Sanitation)

The above table shows that cattle and goats are the most common type of domestic herbivore animal kept in the Project Area. While there are no reliable data available for pigs and domestic fowl such as poultry, guinea fowl, ducks and geese, these animals are also widely kept at homestead level in the project area.

The rangelands within the project area are invariably overstocked, with only the Gangakhulu pasture having a stocking density of 4.67ha/LSU, which falls below the recommended 2.8 - 3.8ha/LSU for the area. Confinement of the livestock within these pastures would only serve to exacerbate the problem unless the herd sizes are either reduced or more land is allocated for grazing. In the currently overgrazed pastures it is imperative that they are fenced off and rehabilitated prior to the project commencement in order to establish a healthy stand of the palatable native grass species to facilitate sustainable grazing (this rehabilitation process will include the control and removal of alien invasive plant species is envisaged to take at least two years prior to the project commencement). The rehabilitation process will require the allotment of alternative grazing areas for the livestock; perhaps using the fallow cropping fields currently being utilised as pastures. It is important to make sure that the amount of land used for grazing in the interim has both the size and capacity to sustainably support the livestock for the duration of the rehabilitation period.

The supply and availability of water in the grazing areas is crucial for the wellbeing and productivity of the animals. The drinking water should preferably be provided in all grazing camps under shelter in order to ensure that the water is cool enough for the animals to drink even in the high summer temperatures experienced in the project area. The water troughs should be built using concrete blocks for durability; they should have a rough textured concrete apron around them on the ground to prevent mud formation and the animals from slipping. The design volume and dimensions of the water troughs should be based on the number of animals and be able to provide enough head-room for the animals to avoid conflict, competition and bullying within the herd. The water flow should be controlled by a floating ball valve to prevent overflow and wastage of water. The design of water reticulation, drinking troughs and grazing paddocks will have to be done in collaboration with the engineers at a detailed design phase.

The idea of improving livestock nutrition by incorporating sugarcane tops and other crop residues into animal feed as expressed in LUSIP (2010) is good however the availability of these crop residues to farmers is a bit questionable, especially since local animal feed millers have secured exclusive supply of large quantities of these crop residues to their feed mills and some sugar mills intend to use bagasse for the generation of electricity. The feeding of crop residues to livestock is mostly expressed in an oversimplified context, which tends to mislead farmers. Assuming that the crop residues like cotton seed cake and sugarcane tops are made available to farmers, certain factors have to be taken into consideration prior to their use. Firstly, it should be noted that these crop residues are not a complete diet but can be used to supplement dry season grazing of livestock since the grass species native to the lowveld provide good quality grazing albeit at a lower nutrient level in the dry season (Relling et al., 2001; Aganga and Tshwenyane, 2004 and Carnevalli et al,. 2006). Sugarcane tops tend to have an appreciable amount of rumen fermentable carbohydrates but have low protein and mineral content compared to those of *Panicum maximum*, *Themeda triandra* and *Urochloa mosambicensis* (Preston, 1977; Glendley et al., 2002; Yuangklang et al., 2005). A detailed report on livestock in the project report is found in Volume 2 Appendix 5.

Cattle grazing on a mixed stand of *Panicum m.*, *Urochloa m., Themeda triandra* between bushes in the project area

Bush encroachment

Bushes and bare patches from overgrazing

4.10.8 Homestead Gardens

33.1% of the households have a homestead garden. These homestead gardens measures between 10 – 40m². Of these only **39.2%** are planted at the current time. **15.2 %** of those who have gardens sell the produce predominantly within the community (**83.3%)** whilst some cite selling in the 'market' (16.7**%).**

4.10.9 Land Use

4.10.9.1 Cropland

The main category Crop Agriculture comprises Small-scale Annual Field Cropping, which consists of individually allocated smallholder Swazi Nation Land. This arable land is characterised by a high percentage (more than 50%) of land currently not used or abandoned. A third of homesteads have cotton and maize fields. Seventeen percent (**17.2%)** of the households grow fruits. Only **2.4%** of these stated that they sell the fruit. Large-scale irrigated field cropping of sugarcane has been developed in several locations by communal smallholder associations.

4.10.9.2 Rangelands

The rangelands provide fodder for livestock and other natural resources.

4.10.9.3 Grazing

There are two types of animal husbandry in the LUSIP 2 study area. The first is Extensive Communal Grazing which takes place on SNL. The second type is commercial ranching at the Government MOA Cattle Ranch. The livestock in the SNL is allocated grazing land according to the chiefdoms; however this does not stop stock owners from moving their animals across their designated grazing lands in search for better grazing.

Table 21: Rangelands and their Livestock

Chiefdom	Rangeland	Total area (ha)	Total LSU	Ha/LSU
Ngcamphalala	Mncumaneni	514.2	973.0	0.53
Ngcamphalala	Ncandweni	232.2	145.7	1.59
Ngcamphalala	Makhasane	242.9	934.2	0.26
Ngcamphalala	Ludlodlo	74.0	689.7	0.11
Ngcamphalala	Ntamakuphila	40.0	280.7	0.14
Ngcamphalala	Mahlabaneni	638.9	1455.9	0.44
Ngcamphalala	Phafeni	984.0	1469.9	0.67
Mngometulu	Gangakhulu	2843.6	500.0	5.69
Matsenjwa	Ndzevane	883.9	400.0	2.21
Matsenjwa	Gamula	1175.6	608.0	1.93
	Totals	9987.2	7457.1	1.34

As indicated in the table, the average stocking density of the Area is 1.34ha/LSU, indicating that the area is overgrazed.

4.10.9.4 Other uses of Natural resources

43.1% of households collect medicinal plants from the surrounding environment. **43.9%** hunt wild animals for food whilst **35.1%** hunt animals for medicinal use. **35.1%** collect plants and for animals for ceremonial purposes.

4.10.10 Gender Status

In the project area 52% of residents are female and 48% are male. The role of household headship at is distributed as shown in the table below:

Table 22: Gender of Head of Household by Chiefdom

Chiefdom	Male		Female	
	N	%	N	%
Matsenjwa	164	66	85	34
Mngometulu	565	72	225	28
Ngcamphalala[1]	162	65	86	35
Total/Average	**891**	**69**	**396**	**31**

Source: LUSIP Phase 2 Census Report

In the instance of irrigated crops, in **71%** of households the head of the household decides what to grow and in **66.7%** of the households the head decides what to do with money derived from these crops of which as shown in the above table, 31% are female.

Of the 3045 people who are formally employed within the project area 777 are female. It is also noteworthy that more female adults are responsible for fetching water compared to male adults.

The detailed socio economic baseline and the gender reports are attached in Volume 2, Appendix 1 and 2 consecutively.

4.11 Archaeological and Historic Sites

There are no known archaeological sites in the area. There are 54 graves that will be affected that are found within the planned irrigation blocks.

4.12 Settlement Patterns

Rural SNL residential use is important throughout. It is split into two subcategories: (1) relatively high density rural residential settlement (homesteads) with gardens and few small fields, and (2) low density residential rural settlement, which is the traditional pattern of homesteads with fields. Settlements in the project area are generally clustered in a nucleated pattern along hillsides or in a linear pattern along primary and secondary roads.

In Ngcamphalala Chiefdom (Phafeni Section) a nucleated cluster of houses, schools and farms lays immediately west of the gravel road and south of the Usuthu River. Separated from this cluster by fields and a ravine forming part of the natural drainage pattern of the

area is a second cluster in a linear north-south pattern along a tertiary dirt road (Mahlabaneni section).

To the south of this cluster, in the Lusabeni Section, settlements become more dispersed and tertiary roads become narrower and less well maintained.

In the Matsenjwa Chiefdom, the settlement pattern consists of two linear clusters located between the main MR8 road and the Lubombo mountain range which forms the border between Swaziland and South Africa to the east.

In Mngometulu Chiefdom, the settlement pattern is generally linear, extending along a network of secondary dirt roads, with the highest density occurring in the northern part of the chiefdom and becoming more scattered to the south.

5. ENVIRONMENTAL IMPACTS ANALYSIS

This chapter examines the potential negative and positive environmental impacts associated with the proposed activities of the LUSIP 2. The chapter opens with wider impacts that are not necessarily project specific but rather issues that require consideration at national policy level. It then goes on to describe project impacts at construction and operation phases.

5.1 Approach

The assessment of environmental and social impacts is presented qualitatively and quantitatively depending on the issues. The potential impacts are described as per the guideline set by the countries, AfDB and the World Bank safeguard policies and procedures. The impacts are also presented in a detailed description and in a summary table. In addition the natures of impacts are described based using the following types of descriptors:

- The study will describe impacts whether they are negative or positive;
- Severity of the impact and geographical extent will be specified;
- The study will also examine the reversibility of the potential negative impact
- Duration and frequency of the impact will be described;
- Timing of the impact whether it is during construction or operation phase
- Circumstance of the impacts and the probability of their occurrence; and
- Significance of the impact will be evaluated

For each impact, the **EXTENT** (spatial scale), **MAGNITUDE** (size or degree scale) and **DURATION** (time scale) are described. These criteria are used to ascertain the **SIGNIFICANCE** of the impact, firstly in the case of no mitigation and then with the most effective mitigation measure(s) in place. This is shown in Table 23.

Table 23: Assessment Criteria for the Evaluation of Impacts

Criteria	Category	Description
Extent or Spatial Influence of Impact	Regional Local Site specific	Beyond a 20 km radius of the site Within a 20 km radius of the site On site or within 100 m of the site
Magnitude of Impact	High Medium Low Zero	Natural and/ or social functions and/ or processes are *severely* altered Natural and/ or social functions and/ or processes are *notably* altered Natural and/ or social functions and/ or processes are *slightly* altered

		Natural and/ or social functions and/ or processes remain *unaltered*
Duration of impact	Short (Construction period) Medium Long Term	Up to 7 years Up to 10 years after construction More than 10 years after construction

The **SIGNIFICANCE** of an impact is derived by taking into account the temporal and spatial scales and magnitude. The means of arriving at the different significance ratings is explained in table 24.

Table 24: Impact Significance

Rating	Level of Criteria Required
High	High magnitude with either a regional extent and medium term duration or a local extent and long term duration
Medium	Medium magnitude with any combination of extent and duration except site specific and construction period or regional and long term
Low	Low magnitude with a site specific extent and construction period duration

Once the significance of an impact has been determined, the **PROBABILITY** of this impact occurring would be determined using the rating systems outlined in Table 25. It is important to note that the significance of an impact should always be considered in concert with the probability of that impact occurring.

Table 25: Definition of Probability Ratings

Probability Ratings Criteria	Description
Definite	Estimated greater than 95 % chance of the impact occurring.
Probable	Estimated 5 to 95 % chance of the impact occurring.
Unlikely	Estimated less than 5 % chance of the impact occurring.

5.2 Summary of Key Impacts Raised by Stakeholders

The cane growing industry in Swaziland is coming under increasing pressure due to environmental issues. The public, especially environmentalists in the country have raised serious concerns over the fact that heterogeneous ecological systems containing a wide diversity of indigenous plants and animals are converted to homogeneous monocultural systems comprised of a single exotic crop. These are calling for the Government to reconsider the continued creation of something called 'green deserts' as these so called 'green deserts are liable for the impacts listed below:

- Natural links between ecosystems are severed, reducing available migration routes.
- Valuable habitats such as riverine areas and wetlands are drained and converted to cultivated land.
- Cane burning is a nuisance, it is potentially hazardous and it impacts negatively on surrounding communities.
- Water flow characteristics in catchments are altered, and the speed of run-off is increased during and immediately after rainfall.
- Soil erosion increases,
- Persistent monoculture reduces soil fertility.
- Fertilisers alter the nutrient balance on cultivated land and also impacts downstream systems.
- Herbicides and pesticides regularly have an impact beyond their specific intended target, and affect indigenous plant and animal life.
- The proliferation of alien invader plant species is an ongoing problem that presents a threat to the indigenous vegetation.

5.2.1 Sugarcane burning

Sugarcane burning has also been cited as an issue of environmental concern that the government should look into. Farmers burn sugarcane to reduce the amount of leafy extraneous material, including stalk tops, delivered with the cane to the factories for processing. The ability of farmers to burn sugarcane is a significant economic factor for the survival of the individual farmer and the sugarcane industry. Nevertheless, research from other countries indicate that mechanical cane harvesting on the other hand is also not efficient with regards to the release of carbon, operational costs and also affects Government efforts to promote employment opportunities. It is understood that a cost-effective mechanism for reducing or eliminating open field burning is a research topic of high importance which however, is beyond the scope of this project.

5.2.2 Climate change and its impacts

Stakeholders are concerned about the contribution of the project to climate change and also the effects climate change will have on the project. The consultant conducted climate change studies on run- off changes based on IPCC studies for the periods 2020-2039 and 2040-2059. The results indicated that changes in rainfall and ETo values are not significant and will not affect runoff. small so it's logical to find here a very small impact of CC on the runoff. The impact of climate change requires further detailed studies and should involve research institutions and the government.

5.2.3 Water Conservation and Demand Management

Stakeholders are concerned that there is little evidence of water conservation and demand management practise in the country with several new water storage and construction schemes either being built or planned. Currently Swaziland is heavily dependent on water for development despite it being a scarce resource. The concern evolves from the fact that sugar cane is a high water consuming crop and therefore it is grown at the expense of food crops that could use less water and bring more benefits. The decision on this aspect is beyond the project scope as the decision on which crop to grow for developed water resources lies within Government spheres.

5.2.4 Use of Chemicals

The growing of sugar cane requires the use of chemicals such as fertilisers, pesticides and herbicides. Stakeholders are concerned that these chemicals may affect nearby water sources and thereby affect human and fish health. The project proponent will have to consider using low toxicity versions of all chemicals used. Application of all chemicals will be done using strict procedures to protect worker and community safety and to minimise overall use.

5.2.5 Food Insecurity

Stakeholders raised concerns over food insecurity in the country while land is converted to sugarcane growing. However this is not expected to be the case for the LUSIP 2 as SWADE is expected to provide the local farmers with the capacity building on knowledge and skills to also cultivate food plots more efficiently and assist them with access to markets to sell their produce and buy other necessary food crops.

5.3 Project Impacts at construction and operation phases

This chapter presents the study team's assessment of the impacts likely to arise as a result of implementing the project. For each impact, the analysis is based on the nature of the issue, the predicted impact, its extent, duration, intensity and probability, and the stakeholders and/or values affected. To avoid excessive chapter length, the text is presented in abbreviated form. The following impacts were identified categorized according to Construction Phase Impacts and Operation Phase Impacts:

5.3.1 Construction Phase Impacts

C1 Land Management

C1.1- Temporary loss of land and contractors' inadequate physical and social management of camps and workforce
C1.2- Unsafe access routes and traffic
C1.3- Permanent loss of land, Health and Safety hazards of operation and closure of borrow pits and quarries.
C-1.4- Improper disposal and treatment of spoil sites
C-1.5 - Improper disposal of solid and liquid waste
C-1.6- Pollution Spills and inadequate clean-up
C-1.7- Dust nuisance and hazard
C1.8- Hazards to workers
C1.9- Landscape change

C2 *Water*

C2.1- Potential decreased water quality as a result of the construction phase activities
C2.2- Sedimentation or rivers and streams pollution of rivers from oil spillage
C2.3- Pollution from sanitation facilities
C2.4- Further increased water turbidity/suspended solids and sedimentation, as a result of increased erosion

C3 Population and Economy

C3.1- Increased population density
C3.2- Transformation of population profile and behaviour patterns
C3.3- Increased employment opportunity
C3.4- Increased financial income
C3.5- Increase in entrepreneurial opportunities
C3.6- Change from subsistence economy to cash economy
C3.7- Increased economic status for some

C4 Resettlement

C4.1- Increased demand for land
C4.2- Reorganization of current settlement patterns
C4.3- Displacement of Community recreational facilities
C4.4-Disruption of cultural setting
C4.5- Impact on host communities
C4.6- Loss of natural resource base

C5 Services

C5.1- Increased demand for social services
C5.2- Increased demand for recreational facilities
C5.3- Increased public traffic load
C5.4- Inhibited access to resources and services
C5.5- Development of new pathways
C5.6- Loss of assets and cultural property

C6 Flora and Fauna

C6.1- Loss of threatened vegetation type
C6.2- Loss of plant species of conservation concern
C6.3- Increased harvesting of natural resources
C6.4- Loss of habitat for fauna species of conservation concern
C6.5- Disruption of ecological corridors

C7 Gender and Human Rights

C7.1- Increased employment opportunities for women and disadvantaged groups
C7.2- Increased financial income for women and disadvantaged groups

O8 Public Health

C8.1- Increased Population density
C8.2- Increase in Malaria prevalence
C8.3- Increased in HIV/AIDS
C8.4- Water-borne diseases
C8.5- Work related accidents and ill-health e.g. traffic accidents and dust
C8.6 Hazards from blasting
C8.7- Hospital, clinics accessibility
C8.8- Drugs and alcohol abuse, social cohesion and crime.

Operational Phase Impacts

O1 Land Management

O1.1- Loss of right to land for descendants of households
O1.2- Increased pressure on land used for subsistence purposes
O1.3- Increased conflicts
O1.4- Decreased grazing land
O1.5- Loss of productivity in livestock farming
O1.6- Decreased access to dip tanks
O1.7- Loss of crop diversity

O2 Ecology

O1.7- Loss of plant species of conservation concern
O1.8- Increased invasion by alien plants
O1.9- Increased harvesting of natural resources
O1.10- Loss of habitat for species of conservation concern
O1.11- Increased hunting of animal resources

O3 Population and Economy

O2.1 Increased Population density
O2.2 Transformation of population profile and behaviour patterns
O2.3- Increased employment opportunity
O2.4- Increased financial income
O2.5- Increased in entrepreneurial opportunities
O2.6- Change from subsistence economy to cash economy
O2.7- Increased economic status for some

O4 Public Health

O4.1- Increased Population density
O4.2- Increase in Malaria prevalence
O4.3- Schistosomiasis prevalence
O4.4- Increased in HIV/AIDS
O4.5- Water-borne diseases
O4.6- Work related accidents and ill-health e.g. traffic accidents and dust
O4.7- Increase in drowning
O4.8- Exposure to toxins
O4.9- Hospital, clinics accessibility or opposite
O4.10- Housing Congestion
O4.11- Drugs and alcohol abuse, social cohesion and crime.

O5 *Climate Change*

O5.1- Increase of the crop water requirement
O5.2- Water resource availability

O6 Air Quality

O6.1 Emission of gases from burning of sugar cane
O6.2 Emission of gases during transportation of sugar cane

O7 Livestock and Rangelands

O7.1- Reduced quality and quantity of grazing area
O7.2- Increased invasion of IAS
O7.3- Reduced access to drinking water for livestock
O7.4- Depreciation of Health of livestock
O8.5 Increased Disputes

O8 Water

O8.1- Chemical Pollution
O8.2- Eutrophication
O8.3- Pollution of groundwater
O8.4- Potential decreased water quality in the Mhlatuzane River as a result of releases from the Lubovane Dam

O9 Community Facilities

O9.1- Increased demand for social services
O9.2- Increased demand for recreational facilities
O9.3- Increased public traffic load
O9.4- Inhibited access to resources and services
O9.5- Improved Water Supply and Sanitation

O10 Community/ Social Organisation

O10.1- Land Disputes
O10.2- Disruption of community organizations and social groupings
O10.3- Increase in social cohesion
O10.4- Increased community grivances

O11 Soils

O11.1- Increase in sodicity in concave colluvial soils
O11.2- Decrease in soil organic content
O11.3- Increase in groundwater salinity and nitrate content

O12- Gender and Human Rights

O12.1 Economic empowerment for women
O12.2 Acquisition of new skills
O12.3 Unequal access and participation
O12.4 Reduced benefits to families
O12.5 Marginalisation of women

O13 Waste Management

O13.1 Improper Management of Solid waste from farm operations

O14 Transboundary Impacts

O14.1 Inability to maintain minimum flows
O14.2 Water unavailability from upstream uses
O14.3 Water logging and soil salinity
O14.4 Pollution of surface water and groundwater resources
O14.5 Contamination of drinking water supplies

5.4 Impact Description

5.4.1 Construction Phase

5.4.1.1 Construction Process

Table 26: Construction Process Impacts

Topic	Impact	Description	Dir[1]	Ext[2]	Dur[3]	Sev[4]	Sig[5]	Pro[6]	Rev[7]
Contractor's Camp	Temporary loss of land and Contractor's inadequate physical and social management of camps and workforce	The construction contractor will need land to establish camps including site offices, workshops, stores, vehicle parking, and staff accommodation. Other land will be needed temporarily for aggregate processing and concrete manufacture, metal fabrication, back-up power generation, and access. The severity of this impact is rated as Medium since this will be a short term impact. The significance is high because land issues in Swaziland are very sensitive as they are a source for most community disputes.	-ve	On site	Short	Medium	High	Definite	R
Construction of	Unsafe access routes	There will be a need to have access roads to contractor	-ve	Local	Short	Medium	High	Definite	R

[1] Direction of Impact (-ve=negative or +ve=positive)
[2] Extent of Impact (onsite, local, regional or National)
[3] Duration Of Impact (long or short term)
[4] Severity of Impact (low, medium or high)
[5] Significance (low, medium or high)
[6] Probability of Occurrence (probable or definite)
[7] Reversibility –(R= Reversible or I= Irreversible)

Possibility of Mitigation: PM (A=Avoidable or NA=Not Avoidable)

Topic	Impact	Description	Dir[1]	Ext[2]	Dur[3]	Sev[4]	Sig[5]	Pro[6]	Rev[7]
access roads & Traffic	and traffic	camp, site offices. The alignment of these access roads may present a risk to other motorists and pedestrians. In some cases, the construction traffic would need to use public roads, which may contribute to the damage of these roads. In addition, there are other issues like dust, noise and safety issues that may arise.							
Construction materials burrowing	Permanent loss of land and Health and Safety hazards of operation and closure of borrow pits and quarries	During construction, there will be a need to for burrowing of suitable materials for construction like sand and gravel for road construction, storm water management and rehabilitation of disturbed areas. The severity of this impact has been rated medium since the borrow sites	-ve	Local	Short	Medium	High	Definite	R
Soil disposal	Improper disposal and treatment of Spoil sites	The project will involve the excavation of soil (construction of canal and access roads), and rock surplus to requirements for fill or unsuitable for re-use in the Works. This will require disposal, taking up land and possibly creating a source of sediment.	-ve	Local	Short	Medium	High	Probable	R
Soil erosion		Removal of vegetation cover exposes the soil, making it prone to erosion. Some parts of the project area are prone to erosion. Clearing activities will be carried out during setting up of camp site, site offices, access roads, canal route, working sites like cement mixing areas, material storage area.	-ve	Local	Short	High	High	Definite	R
Waste management and pollution	Improper disposal of solid and liquid waste Pollution Spills and inadequate clean-up	Camp sites and offices will generate general waste as well as special waste from minor servicing of vehicles, first aid or site mini clinic. If these wastes are not properly managed, they may lead to land pollution as well as being a nuisance to the environment. Spills of oils and other liquid waste would lead to pollution of land and water resources. The project will also involve the use of stationary and mobile	-ve	Local	Short	High	High	Definite	R

Topic	Impact	Description	Dir[1]	Ext[2]	Dur[3]	Sev[4]	Sig[5]	Pro[6]	Rev[7]
		plant and equipment requiring refuelling, mainly with diesel, and the construction of permanent and temporary fuel storage. Accidents and spills usually occur, the two most likely being contamination of soil by used engine oils and the spillage of diesel from mobile bowsers.							
Dust	Dust nuisance and hazard	Canal and dam construction, transportation and land clearing activities will generate a considerable amount of dust, which is a health hazard, a nuisance and cause reduced visibility, which may also lead to accidents.	-ve	Local	Short	Medium	High	Definite	R
	Hazards to workers	Experience of LUSIP I indicate that there will be accidents and injuries during construction of the canal and the dam. If not mitigated the project can impact negatively to the workers and the community. Traffic is going to increase due to the construction activities and accidents and excessive dust are likely to occur in the project area as a result. If not mitigated this can be a serious problem	-ve	On site	Short	High	High	Probable	R[8]
Flooding during construction		Project activities and structures next to rivers may be exposed to flooding risks, especially during the rainy season. This would further be exacerbated by the presence of vertisols within the project area.	-ve	Local	Short	High	High	Probable	I
Aesthetics	Landscape change	Construction sites for workers camp, site offices and other construction works will change the natural landscape of the area.	-ve	local	Short	Medium	Medium	Definite	R

[8] Irreversible

5.4.1.2 Water and Aquatic life

Table 27: Water and Aquatic Life Impacts

Impact	Description	Dir	Ext	Dur	Sev	Sig	Pro	Rev
Potential decreased water quality as a result of the construction phase Activities	Pollutants such as petrol/fuels runoff from roads and other areas within the construction areas (canal route, roads, dam). Deterioration in water quality as a result of the development may affect especially those fish species sensitive to changes in water quality, namely *O. peringueyi* and *C. emarginatus*. Changes in water quality may also affect the primary producers (algae and other aquatic vegetation), which are important food and cover for fish.	-ve	local	Short	High	High	Probable	R
Sedimentation or rivers and streams	Construction activities may cause soil material to get into rivers and streams and cause chocking of aquatic life.	-ve	Regional	Short	High	High	Probable	I
Pollution of rivers from oil spillages	Engine oils and other construction by-products may wash into water bodies and cause pollution of rivers.	-ve	regional	Short	Low	High	Probable	I
Pollution from sanitation facilities	Sanitation facilities in the workers camp may cause pollution from sewer if the facilities are located next to water bodies. In cases where the soil is porous, sewer may seep, polluting groundwater resources.	-ve	Regional	Short	Medium	High	Probable	I
Further increased water turbidity/suspended solids and sedimentation, as a result of increased erosion	Construction activities may cause soil material to get into rivers and streams and cause chocking of aquatic life. It can therefore be deduced that the very high levels of suspended solids observed at times in the study area may be responsible for degradation of the ecological integrity of the aquatic ecosystems. This already high impact on the ecosystem may be further aggravated by LUSIP 2. Decreased flows in the rivers will also result in reduced velocities and smaller freshets, which may cause higher levels of sedimentation and silt to remain in the system for a longer period of time as a result of	-ve	local	short	medium	high	Probable	R

Impact	Description	Dir	Ext	Dur	Sev	Sig	Pro	Rev
	reduced flushing.							

5.4.1.3 Population and Economy

Table 28: Population and the Economy Impacts

Impact	Description	Dir	Ext	Dur	Sev	Sig	Pro	Rev
Increased population density	People may move into the area to take advantage of opportunities. The increased pressure and demand on land may lead to the development and growth of informal settlements.	-ve	Regional	Medium	High	High	Definite	-
Transformation of population profile and behaviour patterns	The influx of people in the area, as well mainly males for construction work may lead to increased promiscuity, higher potential for unwanted pregnancies and commercial sex workers.	-ve	Local	Medium	High	High	Probable	R
Increased employment opportunity	The project will increase the employment opportunities. This will help reduce urban migration, leading to more stable families. The workers will, also benefit for the transfer of skills as they work in the project, which will increase their opportunity for future employment.	+ve	Regional	Long	High	High	Definite	R
Increased financial income	Employment of local population will result in improved income levels for households. This will lead to improved livelihoods, whose effect will impact disadvantaged groups like women and children.	+ve	Regional	Long term	High	High	Definite	R
Increase in entrepreneurial opportunities	Local SMMEs will benefit from the increase in demand for goods and services that will be required both in the construction activities and as a result of increased population in that area.	+ve	National	Long	Medium	High	Definite	-
Change from subsistence	The change of the source of livelihood to irrigated agriculture would imply that there would be requirement for more finances to sustain subsistence	+/_	Local	long	High	High	Definite	-

Impact	Description	Dir	Ext	Dur	Sev	Sig	Pro	Rev
economy to cash economy	needs than before the project. Those families that would not be part of the schemes may feel vulnerable.							
Increased economic status for some	The project will lead to an increased income for some of the community members. The new economic status for some in the population may lead to other members of the community taken advantage of and more vulnerable.	+ve	Local	Local	High	High	Definite	-

5.4.1.4 Resettlement

Table 29: Resettlement Impacts

Impact	Description	Dir	Ext	Dur	Sev	Sig	Pro	Rev
Increased demand of land	There will be homesteads, graves and other structures that would need relocation in the project. Additional land needs to be acquired to cater for the resettled homes and structures, which is a bit of a challenge in Swazi nation land.	-ve	Local	Long	High	High	Definite	I
Reorganization of current settlement patterns.	A total of 22 homesteads will be affected by the construction of the project's main canal (excluding homesteads within the irrigation blocks). Of these households, 19 will definitely be displaced and require resettlement since they fall within 100 meters of the preliminary canal alignment. The support networks between neighbours and with community based organizations may be severed when resettlement occurs	-ve	Local	Long term	Low	High	Probable	I
Displacement of Community recreational and social facilities	One (1) dip tank is affected by the canal and one (1) soccer field will also have to be relocated. There are two (2) dip tanks that are located within the irrigation blocks, one (1) Umphakatsi – Mngometulu and three (3) basic soccer fields located in the irrigation blocks. There is only one shop that could be impacted by the resettlement of the	+ve	Local	Long term	Low	High	Definite	I

Impact	Description	Dir	Ext	Dur	Sev	Sig	Pro	Rev
	affected homesteads. This though may be as a result of whether the homesteads are resettled far away from their current locations.							
Loss of assets and cultural property	A total of 8 ha of arable fields are affected to varying degrees by the canal and reservoir at the end of the canal. There are 54 graves that will be affected. The removal of these to make way for the development will lead to a sense of loss of assets and culturally important property (graves). In addition the exhuming of graves may also lead to the affected families reliving the grief that that had dealt with over a period of time.	+ve	Local	Long term	Low	High	Definite	I
Impact on host communities	The introduction of new homesteads in the host areas will lead to a need for reallocation of resources and disruption of the social setting.	+ve	Regional	Long	Low	High	Definite	I
Loss of natural resource base	The transformation of the land use of the area to irrigated agriculture will lead to the reduction of fuelwood, medicinal plants, handicraft materials and materials for building houses. Loss of bush will undermine the access to 'free' natural resources.	+ve	Local	Long	Medium	Medium	Definite	I

5.4.1.5 Impact on Services

Table 30: Impacts on Services

Impact	Description	Dir	Ext	Dur	Sev	Sig	Pro	Rev
Increased demand for social services	The introduction of new people in the area will lead to an increased demand/pressure for education (increased teacher: pupil ratios), increased demand for police services (increased crime rates).	-ve	Local	Long	High	High	Probable	R
Increased demand for recreational facilities	The project is likely to lead to an increase in the demand for recreational facilities due to increase in local population.	-ve	Local	Long	High	High	Probable	R
Increased public traffic load	There will be an increase in the demand for transport for buses and other public transport as a result of the increase of population in the	-ve	Local	Long	Medium	Medium	Probable	R

Impact	Description	Dir	Ext	Dur	Sev	Sig	Pro	Rev
	area.							
Inhibited access to resources and services	The construction of structures, including the canal will lead to the discontinuation of pathways that are normally used by the community to access fuelwood, neighbours, grazing land and other services.	-ve	Local	Long	Medium	Medium	Probable	R
Development of new pathways	The development of new pathways by construction staff and community members will increase erosion risks in the affected areas.	-ve	Local	Long	Medium	Medium	Probable	R

5.4.1.6 Gender and Human Rights

Table 31: Impacts on Gender and Human Rights

Impact	Description	Dir	Ext	Dur	Sev	Sig	Pro	Rev
Economic Empowerment for women	Possibility of economic empowerment for both women and men under the LUSIP 2, through commercial farming and participation in downstream activities;	+ve	Local	Long	High	High	Probable	-
Acquisition of New skills	Possibility of women acquiring new competencies that will broaden their economic activity scope through training in skills such as, leadership, construction, driving. Communities will also learn the positive aspects of equal participation by women and men in development;	+ve	Local	Long	High	High	Probable	-
Unequal access and participation of women	The treatment of married women as “strangers” and single women as “migrants” in the communities makes equal participation a challenge and promotes the marginalization of the women from the development process; That use of head of household for registration under LUSIP presents a challenge to ensuring equal access and participation of women and men, women still participate in representative capacity. The use of the head of household or man as main beneficiary/player under the LUSIP exacerbates the women’s vulnerability to poverty as their ability to earn income and retain their earning ability is subject to a man’s whims, more especially because of the practice of polygamy.	-ve	Local	Long	Medium	Medium	Probable	R
Reduced benefits to families	Given that data reveals that men do not usually plough money gained back into family welfare, but would rather buy a car in the face of family indigence, for	-ve	Local	Long	High	High	Probable	R

Impact	Description	Dir	Ext	Dur	Sev	Sig	Pro	Rev
	example, the incidence of poverty at the household level is a high risk given the fact that land is registered in man's name and thus directs money to him;							
Marginalisation of women	The marginalization of women from the lucrative downstream activities because of lack of the relevant skills, such as, construction and driving skills. The exclusion of women from better paying farming activities such as, cane cutting, because of existing stereotypes about women's suitability and capacity here;	-ve	Local	Long	Medium	Medium	Probable	R

5.4.1.7 Flora and Fauna

Table 32: Flora and Fauna Impacts

Impact	Description	Dir	Ext	Dur	Sev	Sig	Pro	Rev
Loss of threatened vegetation type	Areas of untransformed vegetation in the study area vary from moderately to poorly representative of Zululand Lowveld, a threatened vegetation type that has been classified as Vulnerable. Destruction of untransformed vegetation will have a significant local impact on biodiversity, and increase the cumulative impact of fragmentation of this vegetation type. Destruction of untransformed vegetation will have a significant local impact on biodiversity, and increase the cumulative impact of fragmentation of this vegetation type. The severity of this impact is rated as High because of its threat status and the current level of transformation of this vegetation type, and since the duration of impact is likely to be permanent, the significance of the impact is rated as High.	-ve	Local	Long	High	High	Definite	I
Loss of plant species of conservation concern	While transformed areas are unlikely to have populations of plant species of conservation concern, it is likely that areas of natural habitat do support such populations. The vegetation communities supporting the most plant species of conservation concern are Acacia nilotica – Grewia	-ve	Local	Long term	High	High	Probable	I

Impact	Description	Dir	Ext	Dur	Sev	Sig	Pro	Rev
	flavescens Low Closed Woodland, Acacia swazica – Sclerocarya birrea Low Open Woodland and Acacia luederitzii – Euclea divinorum Low Closed Woodland, all of which are likely to experience some clearing during the project. Populations of one Schedule A protected species (Bolusanthus speciosus), five Schedule B species (Acacia xanthophloea, Huernia hystrix, Orbea paradoxa, Spirostachys africana and Stapelia gigantea) and four Schedule C species (Aloe marlothii, Aloe parvibracteata, Boscia albitrunca and Sideroxylon inerme) were confirmed to occur in the above three communities and are most likely to be impacted and experience population declines. The severity of this impact is rated as High because of the protection status of the species impacted, the predicted cumulative impacts on species that are already declining, and since the duration of impact is likely to be permanent, the significance of the impact is rated as High.							
Increased harvesting of natural resources	The potential increase of people into the study area through the development of the irrigation project could result in elevated levels of harvesting of natural resources such as fuelwood and traditional medicine. Removal of woody species for fuelwood has a particularly dramatic impact on vegetation structure and canopy cover and results in significant habitat alteration. The severity of this impact is rated as High because of the potential for habitat alteration, and since the duration of impact is likely to be long-term if no mitigation measures are implemented, the significance of the impact is rated as High.	-ve	Local	Long term	High	High	Probable	R
Loss of habitat for fauna species of conservation concern	Areas of untransformed vegetation in the study area support a number of fauna species of conservation concern, particularly large birds of prey, and several of these species potentially breed in the study area. Destruction of untransformed vegetation will decrease the amount of habitat available to these species, and increase the cumulative impact of habitat transformation on species of conservation concern. The severity of this impact is rated as High because of potential loss of populations in	-ve	Local	Long term	High	High	Definite	I

Impact	Description	Dir	Ext	Dur	Sev	Sig	Pro	Rev
	the study area, and since the duration of impact is likely to be permanent, the significance of the impact is rated as High.							
Disruption of ecological corridors	While much of the study area has already been transformed through agriculture, the remaining areas of natural habitat are important refuges and ecological corridors along which fauna can move through transformed habitat. Destruction of these corridors and refuges will render much of the study area uninhabitable for many of the fauna species currently present in the study area. The severity of this impact is rated as Moderate since the corridors and refuges are already fragmented because of previous agricultural activities, and since the duration of impact is likely to be permanent, the significance of the impact is rated as High.	-ve		Long term	High	High	Definite	I

5.4.1.8 Public Health

Table 33: Public Health Impacts

Impact	Comments	Dir	Ext	Dur	Sev	Sig	Pro	Rev	PM
Population density	Population density currently at average stands at 66 habitants per km^2 in the project area. There is likelihood that there will be an increase in population density due to influx of job seekers. Influx of people impact on diseases and family stability by bringing in new strain of pathogens or increase on pathogens dose per person or increase the rate of transmission.	-ve	Local	Short	High	High	Definite	R	A
Malaria prevalence	Malaria is prevalent and endemic but under control. Thanks to the effort of the Malaria Unit that has been able to put malaria under control in the past decade. There is strong likelihood that the malaria gains of the past few years may be compromised by the project due	-ve	Local	Short	Medium	High	Definite	R	A

Impact	Comments	Dir	Ext	Dur	Sev	Sig	Pro	Rev	PM
	to small pools of stagnant waters in ditches created due to environmental modification and littering during construction and irrigation. The project is likely to increase in Malaria prevalence in the project area.								
Increase in HIV/AIDS	HIV/AIDS is prevalent and endemic in the project area. The disease is likely to impact negatively to public health due to the manner in which it is transmitted. Influx of people will exacerbate the prevalence of the disease normally workers are males who don't bring along with them their wife because the conditions at such work environment don't allow them to bring their spouses due to lack of accommodation. Hence they turned to take local women as companion for the time being at work place. This behaviour increase the prevalence of diseases like HIV/AIDS, TB, syphilis, gonorrhoea and genital warts	-ve	Local	Long	High	High	Definite	R	A
Water borne diseases	Water borne diseases are prevalent in the project area. Mostly are experienced during rainy seasons and contribute significant number of patients in the clinics that are in the area. Diseases like cholera; typhoid; diarrheal and dysentery are the most prevalent diseases in the project area.	-ve	Local	Short	High	High	Definite		
Sanitation facilities	Loss of bush will increase the reliance on improved sanitation facilities which the project is bound to provide according to government regulations. It must be noted that materials must be provided on time as communities have been disappointed in the past in this regard.	+ve	Local	Long	High	High	Definite		
Work related accidents and ill-health e.g. Traffic accidents and dust	Experience of LUSIP I indicate that there will be accidents and injuries during construction of the canal and the dam and operation of the irrigation scheme. If not mitigated the project can impact negatively to the workers and the community. Traffic is going to increase due to the construction activities and accidents and excessive dust are likely to occur in the project area as a result. If	-ve	Local	Short	High	High	Probable	R	A

Impact	Comments	Dir	Ext	Dur	Sev	Sig	Pro	Rev	PM
	not mitigated this can be a serious problem								
Hazards from blasting	Three (3) homesteads located outside the periphery of the canal may be affected by blasting. Hazards from blasting will include dust, flyrock and a compromised integrity of structures in homesteads.	-ve	Local	Short	High	High	Probable		
Hospital, clinics accessibility	There are three clinics in the project area. Bholi clinic which is mostly servicing community at Ngcamphalala, Lublini clinic servicing mostly Mngometulu community and Ndzevane clinic servicing mostly Matsenjwa community. These clinics considering proximity to the community seem to be adequate, however the community complain that none of the clinics is able to admit patients yet with the burden of HIV/AIDS three is a need that patients sometimes are admitted. This will now be a demand that one clinic is upgraded to a health centre or hospital considering the magnitude of work to be done and the influx of job seekers.	+ve	Local	Long	High	High	Probable		
Effects on housing	Housing settlement is according to the Swaziland Policy of settlement where there is clearly defined area for agriculture, residential, and livestock. Residential is along the hillsides or settled along the roads. There is a average of 6 people per household. There is likelihood the population will increase considering the activity that will take place. This will impact negatively to public health because some immigrants would want to be accommodated within the community and that communities are likely to lure them to make money on rents. This will cause congestion and diseases like TB might rise. State of household hygiene might be compromised due to difference in habit of new comes.	-ve	Local	Medium	Medium	High	Definite	R	A
Drugs and alcohol abuse, social cohesion and crime.	There is likely-hood that community members will see an opportunity to conduct business of selling alcohol to the workers. This can go as far as opening of shebeens business in their residents where the workers would congregate to drink. This may cause social instability, drugs and alcohol abuse, domestic violence, disturbance in social	-ve	Local	Medium	Medium	High	Definite	R	A

Impact	Comments	Dir	Ext	Dur	Sev	Sig	Pro	Rev	PM
	cohesion and crime.								

5.4.2 Operational Phase Impacts

5.4.2.1 Impacts on Land Management

Table 34: Land Management Impacts

Impact	Description	Dir	Ext	Dur	Sev	Sig	Prob	Rev
Loss of right to land for descendants of households	Swazi Nation Land (SNL) is held in trust by the King for the Swazi Nation and is governed, managed and allocated by Chiefs on behalf of the King. The local Chief may give families the right to grow crops on a certain area or to graze cattle on communal lands through a process known as *Kukhonta*. *Kukhonta* is a process by which an individual seeks residence and/or land in a chiefdom by approaching the local traditional authorities. Such allocations often includes the rights of inheritance by ones descendants. Land is usually allocated to the head of each household within a chiefdom for agricultural activities. The size of the land allocated varies according to availability, the household's needs and resources, social status and lineage. This project, in a bid to make collateral for loans in banks, will result in the conversion of the land to be leasehold land, as opposed to the traditional system where descendants would have claim to the land. There is a concern among the community that the model used in LUSIP I will result in the land rights being eroded as the shares in the proposed farms are vested in only one family member at a time. In this sense only one family member will ultimately 'inherit' the land which was	-ve	Local	Long	High	High	Probable	R

Impact	Description	Dir	Ext	Dur	Sev	Sig	Prob	Rev
	previously used for the benefit of all the family.							
Increased pressure on land used for subsistence purposes	Land on SNL has no exchange rights except through inheritance and family relations, however because farming inputs are becoming expensive for rural farmers, people settled on SNL may seek to sell the rights to a portion of the land allocated to them, which will accelerate change in land use on SNL. The availability of additional irrigated land under LUSIP is expected to increase pressure on land previously used for cultivation of food and subsistence crops, grazing and other purposes.	-ve	Local	Long	High	High	Probable	I
Increased conflicts	Access to new irrigation water under LUSIP will increase conflicts and pressure on SNL, especially land that is presently allocated and used for grazing cattle and growing maize and other food crops. Conflicts will also arise when larger sugarcane farmers attempt to further increase the size of their landholdings at the expense of small farmers, who would to an increasing extent become workers for larger farmers or concessionaires.	-ve	Local	Long	High	High	Probable	R
Decreased grazing land	Land use on SNL can be expected to change dramatically as small subsistence fields and dryland maize or cotton fields surrounded by communal grazing lands are converted to irrigated fields, leaving smaller areas for cultivating maize or vegetables. Winter grazing lands for cattle on rich alluvial soils along the riverbanks will diminish, as will large amounts of summer grazing lands around the fields.	-ve	Local	Long	High	High	Probable	I
Loss of productivity in livestock farming	The Ministry of Agriculture farm that will be used in the project is currently used as a breeding station to assist farmers in livestock farming. Conversion of this land for arable agriculture will lead to a reduction of productivity for livestock farming, which will affect not only the project area, but livestock farming in the country.	-ve	Local	Long	High	High	Probable	I
Loss of crop	It is perceived that there is currently better food security as the staple food, maize, is being planted. As sugarcane is not a food crop, the families will	-ve	National	Long	Medium	Medium	High	R

Impact	Description	Dir	Ext	Dur	Sev	Sig	Prob	Rev
diversity	have to rely on commercially bought maize. In some instances the budgeting abilities of the families is not yet developed sufficiently to rely on cash only for all their needs.							
	Existing famers associations warn that at the inception phase of the irrigated farm blocks, the dividends achieved are not sufficient for family food requirements.	-ve	Local	Short	Medium	Medium	High	R
	It must be noted that even where farmers have been encouraged to grow other crops alongside the sugarcane, this has not been achieved on a significant scale for example in the KDDP.	-ve	National	Medium	Medium	Medium	High	R

5.4.2.2 Impacts on flora and fauna

Table 35: Flora and Flora Impacts

Impact	Description	Dir	Ext	Dur	Sev	Sig	Pro	Rev
Loss of plant species of conservation concern	While transformed areas are unlikely to have populations of plant species of conservation concern, it is likely that areas of natural habitat do support such populations. The vegetation communities supporting the most plant species of conservation concern are Acacia nilotica – Grewia flavescens Low Closed Woodland, Acacia swazica – Sclerocarya birrea Low Open Woodland and Acacia luederitzii – Euclea divinorum Low Closed Woodland, all of which are likely to experience some clearing during the project. Populations of one Schedule A protected species (Bolusanthus speciosus), five Schedule B species (Acacia xanthophloea, Huernia	-ve	Local	Long term	High	High	Probable	I

Impact	Description	Dir	Ext	Dur	Sev	Sig	Pro	Rev
	hystrix, Orbea paradoxa, Spirostachys africana and Stapelia gigantea) and four Schedule C species (Aloe marlothii, Aloe parvibracteata, Boscia albitrunca and Sideroxylon inerme) were confirmed to occur in the above three communities and are most likely to be impacted and experience population declines.							
Increased invasion by alien plants	Areas that are to be cleared for cultivation will provide a base from which invasive alien species could establish and invade adjacent natural habitat. A seed-base for these species already exists and includes species that are currently a severe threat to biodiversity in Swaziland, such as *Parthenium hysterophorus, Chromolaena odorata* and *Lantana camara*. The severity of this impact is rated as High because of the potential for habitat transformation by invasive alien plants, and since the duration of impact is likely to be long-term if no mitigation measures are implemented, the significance of the impact is rated as High.	-ve	Regional	Long term	High	High	Probable	I
Increased harvesting of natural resources	The potential increase of people into the study area through the development of the irrigation project could result in elevated levels of harvesting of natural resources such as fuelwood and traditional medicine. Removal of woody species for fuelwood has a particularly dramatic impact on vegetation structure and canopy cover and results in significant habitat alteration.	-ve	Local	Long term	High	High	Probable	R
Loss of habitat for fauna species of conservation concern	Areas of untransformed vegetation in the study area support a number of fauna species of conservation concern, particularly large birds of prey, and several of these species potentially breed in the study area. Destruction of untransformed vegetation will decrease the amount of habitat available to these species, and increase the cumulative impact of habitat transformation on species of conservation concern.	-ve	Local	Long term	High	High	Definite	I
Increased hunting of animal resources	The potential increase of people into the study area through the development of the irrigation project could result in elevated levels of harvesting of natural resources such as bush meat and traditional	-ve	Local	Long term	Medium	Medium	Probable	R

Impact	Description	Dir	Ext	Dur	Sev	Sig	Pro	Rev
	medicine. The severity of this impact is rated as Medium since target bushmeat species such as antelope are already low, although valuable species for the traditional medicine market are present (e.g. Southern African Python). The significance of the impact is rated as Medium.							

5.4.2.3 Population and Economy

Table 36: Population and Economy Impacts

Impact	Description	Dir	Ext	Dur	Sev	Sig	Pro	Rev
Increased population density	People may move into the area to take advantage of job and entrepreneurial opportunities. The increased pressure and demand on land may lead to the development and growth of informal settlements.	-ve	Local	Long	Low	High	Probable	R
Transformation of population profile and behaviour patterns	The influx of people in the area, as well mainly males for construction work may lead to increased promiscuity, higher potential for unwanted pregnancies and commercial sex workers.	-ve	Local	Long	Low	High	Probable	R
Increased employment opportunity	The project will increase the employment opportunities. This will help reduce urban migration, leading to more stable families. The existing skill set within the community is not based on commercial farming. Through training by SWADE, the community will benefit in increased comme5rcial farming and business management skills.	-ve	Local	Long	Low	High	Probable	R
	Despite low levels of wage employment among local people, it is perceived that those employees who have dividends in the farmers association are difficult to manage.	-ve	Local	Short	Low	Low	Low	R
	Women will not have equal opportunities of being employed in jobs that are considered unsuitable such as cane cutting or security provision.	- ve	Local	Med	Low	Medium	Probable	R

Impact	Description	Dir	Ext	Dur	Sev	Sig	Pro	Rev
	Outsiders are often employed on large scale projects if the relevant skill set is not available in the community or that. The high rate of unemployment leads to resentment against outsiders.	- ve	Local	Med	Low	Medium	Probable	R
Increased financial income	Employment of local population will result in improved income levels for households. This will lead to improved livelihoods, whose effect will impact disadvantaged groups like women and children.	+ve	Local	Long	Medium	High	Definite	R
Increase in entrepreneurial opportunities	Local SMMEs will benefit from the increase in demand for goods and services that will be required both in the construction activities and as a result of increased population in that area.	+ ve	National	Long	Medium	High	Definite	-
Change from subsistence economy to cash economy	The change of the source of livelihood to irrigated agriculture would imply that there would be requirement for more finances to sustain subsistence needs than before the project. Those families that would not be part of the schemes may feel vulnerable.	-ve	Local	Long	Low	High	Probable	R
Increased economic status for some	The project will lead to an increased income for some of the community members. The new economic status for some in the population may lead to other members of the community taken advantage of and more vulnerable.	+ve	Local	Long	Low	High	Probable	R

5.4.2.4 Impacts on Public Health

Table 37: Public Health Impacts

Impact	Comments	Dir	Ext	Dur	Sev	Sig	Pro	RV	PM
THEME 1: Demography issues									
Population density	Population density currently at average stands at 66 habitants per km^2 in the project. There is likelihood that there will be an increase in population density due to influx of job seekers. Influx of people impact on diseases and family stability by bringing in new strain of pathogens or increase on pathogens dose per person or increase the rate of transmission.	-ve	Local	Long	Medium	Medium	Definite	R	A
THEME 2: Vector-related diseases									
Malaria prevalence	Malaria is prevalent and endemic but under control. Thanks to the effort of the Malaria Unit that has been able to put malaria under control in the past decade. There is strong likelihood that the malaria gains of the past few years may be compromised by the project due to small pools of stagnant water in ditches created due to environmental modification and littering during irrigation. The project is likely to increase malaria prevalence in the project area.	-ve	Local	Long	Medium	High	Definite	R	A
Schistosomiasis prevalence	Schistosomiasis is prevalent and endemic in the project area and there is likelihood that the disease will increase due to available slow moving water in the canal and dam to be built at the end of the canal	-ve	Local	Long	Medium	High	Definite	R	A
Rabies prevalence	Rabies is not prevalent but does occur from time to time and may be exacerbated by the project implementation.	-ve	Local	Short	Low	Low	Unlikely	NA	NA

Impact	Comments	Dir	Ext	Dur	Sev	Sig	Pro	RV	PM
THEME 3: Sexually transmitted infections									
Increase in HIV/AIDS	HIV/AIDS is prevalent and endemic in the project area. The disease is likely to impact negatively to public health due to the manner in which it is transmitted. Influx of people will exacerbate the prevalence of the disease normally workers are males who don't bring along with them their wife because the conditions at such work environment don't allow them to bring their spouses due to lack of accommodation. Hence they turned to take local women as companion for the time being at work place. This behaviour increases the prevalence of diseases like HIV/AIDS, TB, syphilis, gonorrhoea and genital warts	-ve	Local	Long	Medium	High	Probable	I	A
THEME 4: Sanitation/ water-borne diseases									
Water borne diseases	Water borne diseases are prevalent in the project area. Mostly are experienced during rainy seasons and contribute significant number of patients in the clinics that are in the area. Diseases like cholera; typhoid; diarrheal and dysentery are the most prevalent diseases in the project area. The project is likely to impact positively because there project come with a component of clean water supply for domestic use. Water-borne diseases are going to reduce after the implementation of the project. Issues of children under 5 yrs who do not use pit toilet and medical waste generated from home base care activities water down the gains made by clean water supplies.	-ve	Local	Long	Medium	High	Probable	R	A
THEME 5: Food- and Nutrition related diseases									
Food available, quantity and quality	The Swazi staple food is maize, that is the source of starch for the Swazi nation and the community in the project area is no exception. The project is likely to impact positively on food	+ve	Local	Long	High	High	Probable		

Impact	Comments	Dir	Ext	Dur	Sev	Sig	Pro	RV	PM
	quality and quantity. This is causes besides the planting of sugar cane, farmers will also have 0.5 of a hectare where they will plant maize and they will also have plots to grow vegetables. This will give communities balance diets which will impact positively on those diseases are prevented by eating balance diet.								
THEME 6: Accidents and ill-health									
Work related accidents and ill-health e.g. Traffic accidents and dust	Experience of LUSIP I indicate that there will be accidents and injuries during operation of the irrigation scheme. If not mitigated the project can impact negatively to the workers and the community. If not mitigated this can be a serious problem	-ve	Site	Long	Medium	High	Probable	I	A
Increase in Drowning	Experience of LUSIP I indicate that the project may impact negatively to the community especially children who, despite of warnings and fencing of the dam and canal, they continue to cut fence and access the canal.	-ve	Local	Long	Medium	High	Probable	I	A
THEME 7: Exposure to potentially hazardous materials									
Exposure to toxins	Most toxins the community or workers may be exposed to are discarded and chemicals mostly used for insect control in agriculture. This may impact negatively if not mitigated.	-ve	Local	Long	Medium	High	Probable	I	A
THEME 8: Health systems									
Hospital, clinics accessibility or opposite	There are three clinics in the project area. Bholi clinic which is mostly servicing community at Ngcamphalala, Lublini clinic servicing mostly Mngometulu community and Ndzevane clinic servicing mostly Matsenjwa community. These clinics considering proximity to the community seem to be adequate, however the community complain that none of the clinics is able to admit patients yet with the burden of HIV/AIDS three is a need that patients sometimes are admitted. This will now be a demand that one clinic is upgraded to a health centre or	+ve	Local	Long	Low	Medium	Probable		

Impact	Comments	Dir	Ext	Dur	Sev	Sig	Pro	RV	PM
	hospital considering the magnitude of work to be done and the influx of job seekers.								
THEME 9: Housing condition									
Effects on housing	Housing settlement is according to the Swaziland Policy of settlement where there is clearly defined area for agriculture, residential, and livestock. Residential is along the hillsides or settled along the roads. Currently there is an average of 6 people per household. There is likelihood the population will increase considering the activity that will take place. This will impact negatively to public health because some immigrants would want to be accommodated within the community and that communities are likely to lure them to make money on rents. This will cause congestion and diseases like TB might rise. State of household hygiene might be compromised due to difference in habit of new comes.	-ve	Local	Long	Medium	Medium	Definite	I	A
THEME 10: Health Indicators									
Effect on birth rate	No change								
Effect on mortality rate	Improved	+ve	Regional	Long	High	High	Definite		
Effect on Life expectancy	Life expectancy might improve due to the improved nutrition and general health services (if upgrading of one clinic to a health centre is approved) and improved in water supply and sanitation. There will be positive impacts on this category.	+ve	Regional	Long	Low	Medium	Probable	I	NA
Effect on immunization coverage	No change								
Ratio of patient to health worker at health facility	The increase in the population of the area, with the increased expectation of job opportunities in the farms will increase the patient to health worker ratio in the health facilities of the area.	-ve	Local	Long term	Medium	Low	Probable	R	A

Impact	Comments	Dir	Ext	Dur	Sev	Sig	Pro	RV	PM
Access to services (education, and health),	No change								
THEME 11: Psycho-Social/life style									
Drugs and alcohol abuse, social cohesion and crime.	There is likely-hood that community members will see an opportunity to conduct business of selling alcohol to the workers. This can go as far as opening of shebeens business in their residents where the workers would congregate to drink. This may cause social instability, drugs and alcohol abuse, domestic violence, disturbance in social cohesion and crime.	-ve	Local	Long	Medium	Low	Probable	R	A

5.4.2.5 Climate Change Impacts

Table 38: Climate Change Impacts

Impact	Description	Dir	Ext	Dur	Sev	Sig	Pro	Rev
Increase of the crop water requirement	The scenario tested, the climate change would have an impact on the crop requirement, which will increase up to 5% or 10%.	-ve	Local	Long	High	High	Definite	I
Reduced Water resource availability	The projected changes in rainfall and evapotranspiration data in are small so it's logical to find here a very small impact of Climate Change on the runoff.	-ve	Regional	Long	Low	High	Not likely	I

5.4.2.6 Air Quality Impacts

Table 39: Air Quality Impacts

Impact	Description	Dir	Ext	Dur	Sev	Sig	Pro	Rev
Emission of gases during burning of sugar cane	If burning is done during harvesting of sugar cane, there would be emission of gases like POPs, SOx, NOx, particulates, which may be a nuisance and cause pollution of the atmosphere. Green house gases may also be emitted, contributing to climate change.	-ve	Local	Long	High	High	Definite	I
Emission of gases from transportation of cane to Mill	During transportation of sugarcane for processing, there will be emission of gases like sulphur, oxides of nitrogen and other gases that may cause air pollution.	-ve	Local	Long	High	High	Definite	I

5.4.2.7 Impact on Livestock and rangelands

Table 40: Impacts on Livestock and Rangelands

Impact	**Description**	**Dir**	**Ext**	**Dur**	**Sev**	**Sig**	**Pro**	**Rev**
Reduced quality and quantity of grazing area	When project implementation begins there will be reduced the available grazing land, which will lead to potential overstocking and subsequent decimation of the grazing resource leading to a marked loss of livestock productivity as well as potential stock losses. The calculated current stocking density in the entire project area is 0.75 hectares per livestock unit (450kg bovine), whereas the recommended stocking density of the area ranges from 2.8 to 3.8 hectares per LSU. On commencement of the project this cropping land will be reclaimed for crop production, leaving the animals with even less land available for grazing	-ve	Local	Long	High	High	Definite	I

Impact	Description	Dir	Ext	Dur	Sev	Sig	Pro	Rev
	hence the land and vegetation will not be capable of sustaining the large numbers of animals.							
Increased invasion of IAS	There is increasing ground coverage of the alien invader species weed *Parthenium Hysterophorus*, which is a definite sign of disturbance and overgrazing.	-ve	Regional	Long	High	High	Definite	I
Reduced access to drinking water for livestock	Grazing patterns in the project area indicate that farmers would like to keep the animals in close proximity to the river for drinking water. Fencing off some areas for crop farming and along the canal route will decrease the access points of livestock to water.	-ve	Local	Long	High	High	Probable	I
Depreciation of health of livestock	If the animals are confined within overgrazed pastures on commencement of the project, will have insufficient grazing and as a result would start consuming alien invasive plant species. The more abundant *Parthenium* contains a toxin known as parthenin, a sesquinterpene lactone (Narasimhan et al, 1984). This weed is therefore pathogenic to both livestock and people, causing rhinitis, fever, rashes, ulcerations and necrosis in cattle (Singh et al, 2010). In extreme cases of toxicity this toxin has been known to cause death of both cattle and water buffalo.	-ve	Local	Long	High	High	Probable	I
Increased Disputes	The reduction in grazing area may lead to livestock encroaching into commercial farms, and sometimes the herders cut fences to along the livestock to pass through. This will lead to more cases of livestock impoundment, leading to increased strife between neighbouring farm owners and the community.	-ve	Local	Long	Medium	Medium	Probable	R

5.4.2.8 Water Management

Table 41: Impacts on Water Management

Impact	Description	Dir	Ext	Dur	Sev	Sig	Pro	Rev
Chemical Pollution	Improper storage of chemicals and fertilizers may lead to these chemicals finding a way to water resources, leading to pollution of rivers and streams, affecting the quality of downstream users of the water. Surface runoff from these areas is also likely to show increased levels of nutrients derived from the leaching out of fertilizers.	-ve	Local	Long	High	High	Probable	I
Eutrophication	Nitrate and phosphate levels will also be increased, particularly during the wet season and after the current practice of burning the cane residues. Phosphate levels are currently high in the lower Usuthu, and any further increase will heighten the current risk of eutrophication	-ve	Local	Long	High	High	Probable	I
Potential decreased water quality in the Mhlathuzane River as a result of releases from the Lubovane Dam	Controlled releases from the Lubovane Dam results to poor water quality in the river downstream of the dam wall. This could have a direct effect on fish and invertebrates intolerant to changes in water quality. Eutrophic conditions may develop in the river if the compensation flows have a high nutrient status, leading to deoxygenation and fish kills.	-ve	Local	Long	High	High	Probable	I
Pollution of groundwater	The VIP toilets that will be supplied under the project may lead to pollution of groundwater resources if the toilets are sited and designed with no consideration of the porocity of the soils and the water table level. Improper irrigation practices and application of agrochemicals may lead to the leaching of agrochemicals into groundwater.	-ve	Local	Long	High	High	Probable	I

5.4.2.9 Community facilities

Table 42: Impacts on Community Facilities

Impact	Description	Dir	Ext	Dur	Sev	Sig	Prob	Rev
Increased demand for social services	The introduction of new people in the area will lead to an increased demand for education (increased teacher: pupil ratios), increased demand for police services (increased crime rates).	-ve	local	Long	High	High	Probable	-
Increased demand for recreational facilities	The project is likely to lead to an increase in the demand for recreational facilities due to increase in local population.	-ve	Local	Long	Medium	Medium	Probable	-
Increased public traffic load	There will be an increase in the demand for transport for buses and other public transport as a result of the increase of population in the area.	-ve	Local	Long	Low	Low	Probable	R
Inhibited access to resources and services	The construction of structures, including the canal will lead to the discontinuation of pathways that are normally used by the community to access fuelwood, neighbours, grazing land and other services.	-ve	Local	Long	Medium	Medium	Probable	R
Improved Portable water supply	Access to water will be restricted especially as rivers and tributaries will be curtailed by the setting up of irrigated farms. The project plans to improve access to portable water thereby improving the health and safety of the community.[9]	+ve	Local	Long	High	High	Definite	R
	Operations and maintenance of water supply systems have been a challenge to most communities in the past.	-ve	Local	Long	High	High	Probable	R

[9] The standard for LUSIP phase I (as well as national and international) is 200m from every homestead

5.4.2.10 Community/Social Organisation

Table 43: Impacts on Community/Social Organization

Impact	Description	Dir	Ext	Dur	Sev	Sig	Pro	Rev
Land Disputes	Conflicts and disputes involving SNL may arise from several causes, e.g. within a chiefdom due to competing allegiances to different chiefs; between neighboring chiefdoms, which include claims on the same territory, and between local chiefs and other parties owning, leasing, or granting use rights to non-SNL land within a chiefdom's territory. The implementation of the project may further exacerbate these disputes when people under a chiefdom are putting together a scheme.	-ve	Local	Long	Medium	High	Probable	R
Disruption of community organizations and social groupings	The introduction, movement and relocation of people will change the profile of the population in the project area, resulting in the disruption of the original social setting. The support networks between neighbours and with community based organization may be severed when resettlement occurs.	-ve	Site	Long	Low	Low	Probable	I
Increase in social cohesion	The formation of farmer schemes will lead to the increase in social cohesion, especially within those in the same farmer association. Information exchange and cot sharing between the different farmers associations may also increase positive social interactions.	+ve	Local	Long	Low	Medium	Probable	
Increased Grievances	Community members are concerned that whilst their grievances may be noted throughout the project cycle, these may not be attended to.	-ve	Local	Short	Medium	Medium	Probable	I
	It is perceived among the community that other national infrastructure projects do not adhere to the regulations on environmental and social impacts.	- ve	Local	Long	High	High	Probable	I

5.4.2.11 Gender and Human Rights

Table 44: Impacts on Gender and Human Rights

Impact	Description	Dir	Ext	Dur	Sev	Sig	Pro	Rev
Economic Empowerment for women	Possibility of economic empowerment for both women and men under the LUSIP 2, through commercial farming and participation in downstream activities;	+ve	local	Long	High	High	Probable	-
Acquisition of New skills	Possibility of women acquiring new competencies that will broaden their economic activity scope through training in skills such as, leadership, construction, driving. Communities will also learn the positive aspects of equal participation by women and men in development;	+ve	Local	Long	High	High	Probable	-
Unequal access and participation of women	The treatment of married women as “strangers” and single women as “migrants” in the communities makes equal participation a challenge and promotes the marginalization of the women from the development process; That use of head of household for registration under LUSIP presents a challenge to ensuring equal access and participation of women and men, women still participate in representative capacity. The use of the head of household or man as main beneficiary/player under the LUSIP exacerbates the women’s vulnerability to poverty as their ability to earn income and retain their earning ability is subject to a man’s whims, more especially because of the practice of polygamy.	-ve	Local	Long	Medium	medium	Probable	R
Reduced benefits to families	Given that data reveals that men do not usually plough money gained back into family welfare, but would rather buy a car in the face of family indigence, for example, the incidence of poverty at the household level is a high risk given the fact that land is registered in man’s name and thus directs money to him;	-ve	Local	Long	High	High	Probable	R
Marginalisation of women	The marginalization of women from the lucrative downstream activities because of lack of the relevant skills, such as, construction and driving skills. The exclusion of women from better paying farming activities such	-ve	Local	Long	Medium	Medium	Probable	R

Impact	Description	Dir	Ext	Dur	Sev	Sig	Pro	Rev
	as, cane cutting, because of existing stereotypes about women's suitability and capacity here;							
Reduced access to natural fuelwood	The clearing of vegetation will lead to a reduced supply of firewood which impacts more on women who are expected to prepare meals for their families.	-ve	Local	Long	Medium	High	Probable	R

5.4.2.12 Soils

Table 45: Impacts on Soils

Impact	Description	Dir	Ext	Dur	Sev	Sig	Pro	Rev
Increase in sodicity in concave colluvial soils	Inadequate drainage, increased bedrock weathering and low conductivities in some areas within the project area will lead to increase sodicity in these areas.	-ve	Local	Long	Medium	High	Probable	R
Decrease in soil organic content	The intensive cultivation of crops and burning of sugarcane may lead to a decrease in organic content for the soils, especially S-sets.	-ve	Local	Long	Medium	Medium	Probable	R
Increase in groundwater salinity and nitrate content	The application of fertilizers, which contain high nitrates may lead to leaching of the nitrates into groundwater.	-ve	Local	Long	Medium	High	Probable	I

5.4.2.13 Waste Management

Table 46: Waste Management Impacts

Impact	Description	Dir	Ext	Dur	Sev	Sig	Pro	Rev
Improper solid waste management from farm operations	During farm operations, waste will be generated. Some of these waste streams are hazardous (empty chemical containers, expired chemicals, etc)	-ve	Local	Long	Medium	High	Probable	R

Table 47: Transboundary Impacts

Impact	Description	Dir	Ext	Dur	Sev	Sig	Pro	Rev
Inability to maintain minimum flows	Inability to maintain minimum flows in the Usuthu River downstream from offtake at Bulungapoort and at international borders to RSA and Mozambique	-ve	Regional	Long	High	High	Probable	R
Water Unavailability	Non-availability of water for allocation to LUSIP due to high priority upstream uses	-ve	Regional	Long	High	High	Probable	R
Water logging and soil salinity	Inadequate drainage of excess water resulting in waterlogging and increased soil salinity	-ve	Regional	Long	Medium	High	Probable	R
Pollution of surface and groundwater resources	Accumulation of toxic agrochemical residues in surface and groundwater	-ve	Regional	Long	High	High	Probable	I
	Contamination of drinking water supplies	-ve	Local	Long	High	High	Probable	R

6. PROJECT ALTERNATIVES

The analysis of project alternatives in the context of the proposed LUSIP 2 was based on the basis that in the year 2000 a number of alternatives were considered for the entire project (LUSIP phase 1 and 2). These included comparisons between the various low capital-cost improvements to the existing rural systems, minor irrigation alternatives, different institutional models and determination of the most suitable option. Therefore, for the LUSIP 2 studies only the following aspects were considered: soils and land suitability, water availability and irrigation, economic and financial feasibility of the proposed project, field irrigation systems and the no project alternative.

6.1 Soils and Land Suitability

The results of the soils, land suitability and land use studies and the corresponding scenarios are summarized in the table below.

Table 48: Scenarios for Development of land for Irrigated Sugarcane (ha)

Class	Name	Scenario 1	Scenario 2	Scenario 3	Scenario 4
		Entire Survey Area	Communal Area without MOA Farm	Matata Block	Entire area minus W2,C3,C4
S1	Very Suit	474	474	26	474
S2	Suitable	3,280	2664	2,716	2,807
S3	Marg Suit	2,787	1,955	2,391	2,099
N	N1 very sh	2,648	2,130	2,318	1,823
N	N1vertisols	238	108	223	238
N	Not Suit	8,768	6,321	8,062	5,952
Total Area		**18,195**	**13,652**	**15,736**	**13,392**

Scenario 4 would result in the availability of a total net area of approximately 5,750ha (455ha existing and 5,295ha new land), with 3,477 ha below the main conveyor and 2,273 ha above the conveyor. In terms of suitability, half of this is S2 suitable land, a quarter S3 marginally suitable land, with the remainder either very suitable S1 or conditionally suitable N1.

In order to obtain a realistic overview of the hectarage available of the various land suitability categories, the following modifications were made considering the position of the land, in particular with reference to the main conveyor: (i) all marginally suitable and suitable land was eliminated when situated higher than 210m, with exception of the very suitable land; (ii)

all marginally suitable land above the canal at 190m was eliminated; (iii) not more than 50% of land classified as N1 very shallow (subject to survey) and located below the conveyor was included (lower than 190m); and (iv) all land classified as N1 Vertisols below 210m was included.

6.2 Water Availability and Irrigation

Reviews of previous water resources studies up to 2005 indicate that there is sufficient water for 12,500 ha in LUSIP1&2. Detailed hydrological data could not be made available, but additional detailed studies confirmed the findings of the review and showed that an additional 4,000 ha can be irrigated in a LUSIP extension area comprising existing and new storage dams.

The bulk water supply system has been designed taking into account topography, soil and geotechnical conditions and especially the dispersed distribution of about 6,000ha suitable soils over an area of 18,195ha. Without lined and piped main conveyor system and secondary piped distribution system under pressure sustainable irrigated agriculture is not possible. The distribution system is designed to supply water at the correct quantities and pressures to allow overhead irrigation comprising centre pivot and semi solid sprinkler systems. The system capacity is sufficient to supply in initial stage large quantities of water for furrow irrigation.

6.3 Economic and Financial feasibility Analysis

Analyses have been carried out for 100% sugarcane and 100% mixed crops. Farm and project IRR's were calculated. Project IRRs will be negative if all investments for the water supply system are included.

Table 49: Selection of Sizes of Farms

	Sugarcane				Mixed Crops			
Area (ha)	6,450				6,450			
Farm gate price	2,252 E/ton sucrose		2,600 E/ton sucrose		2,000 E/ton		2,600 E/ton	
Farm size (ha)	100	500	100	500	100	500	100	500
Cane yield (t/ha)	96	100	96	100				
IRR								
w/out grant	-0.5%	0.6%	1.8%	3.1%	-2.6%	-1.1%	0.8%	2.3%
with grant	15.0%	19.2%	22.2%	27.5%	10.1%	13.8%	19.5%	24.7%

Cash flow in 2018 after grant for bulk water supply (Bulk water supply system: 100% grant, farm developm: 7%/10 yrs, irrig. system: 7%/20 yrs								
Cash flow	46.4	63.4	74.7	92.9	17.0	33.5	55.8	74.2
Debt service	49.9	49.9	49.9	49.9	46.6	46.6	46.6	46.6
To farm households	-3.5	13.5	24.8	43.0	-29.6	-13.1	9.2	27.6

The case with 500 ha farms will allow sharing of costs and improve profitability under conditions that the main investment comprising the bulk water supply system is provided on a grant basis. It is foreseen that for the 500 ha farms highly qualified farm managers will be employed who would have to be well paid. The production of sugarcane, an established crop in the area has to still to prove its viability. According to the above table mixed crops would generate a slightly lower rate of return compared to sugarcane. Options for farms to recover some of the main investment costs have been assessed as to be difficult. Detailed analyses are shown in the tables below. The sucrose price for 2011/12 was E 2,252, while farm gate prices for the 2012/13 season are forecasted at E 2,600 with the possibility of further increases. The profitability of the farm activity must allow the servicing of debts and must also satisfy the aspiration of farmers for a reasonable income (an assumption is that 2,000 households are being paid a dividend of E 15,000, which would amount to about E 30 M/year.

The base case for sugarcane production (farm gate price of E 2,252 paid in 2011/, 100 ha farm, financed at 15% interest and repayable over 8 years) is hardly a viable option as farmers would not be able to service their debts and receive any dividend from farming. Yield and price increases improve the viability of sugarcane production. However, only when the bulk water supply is provided on a grant basis, when investment costs are slightly reduced, when present budget prices are applied and yields slightly increase will it be viable to produce sugar cane. This would also require substantially lower interest rates (say 7%) and variable repayment periods for farm assets.

Option 5 offers such a possibility to establish a profitable sugarcane production, allowing debts to be serviced and farm household to benefit from a distribution of the surplus generated.

6.3.1 Sensitivity Analysis of 100% sugarcane Feasibility

Table 50: Sensitivity Analysis of 100% Sugarcane Feasibility

Sugarcane	Area ha	Price/ ton	Yield (ton)	GM 4th year E 1000	Payment to farmers E 1000	Farm IRR %	IRR after grant	Fin.cost
1.Base case	4,893	2,254	96	60,134	-54,218	8.3	10.8	15%
2. Drop N1>180 (541 ha)	4,352	2,254	97	56,284	-44,309	9.7	12.1	15%
3. Increase yields by 10%	4,893	2,254	105	72,786	-30,470	14.0	14.9	15%
4. Price increase by 10%	4,893	2,480	96	74,767	-26712	14.9	15.6	15%
5. Price +10%, interest rate 5%, yield +5%, farm investment – 5%	4,352	2,480	100	81,839	22,281	19.5	19.2	5%

Case 2 for sugarcane suggests that profitability may improve by eliminating production on unsuitable land. Options 3 and 4 test changes in prices and yields, but to no avail as farmers are still unable to generate a positive cash income. Case 5 simulates various factor changes which have to be addressed. The increase in prices and yields, the reduction of costs for farm investments and reducing drastically the cost of financing are ways to pursue a feasible project environment. Option 5 would provide a cash inflow of E 22 million available to the farming community and is the type of outcome the project should be looking for.

6.3.2 Sensitivity Analysis of 100% mixed crops Feasibility

Table 51: Sensitivity Analysis for 100% mixed crops Feasibility

Mixed Crops	Area (ha)	Maize E/ton	GM 4th year (E 1000	Payment to farmers (E 000)	Farm IRR	IRR after grant	Interest rate
1. Base case	4,893	2,000	38,875	-53,058	-1.6	10.6	15
2. Yield increase by 10% (maize only)	4,893	2,000	49,566	-37,005	3.2	13.4	15
3. Price increase 10% (maize only)	4,893	2,200	50,650	-35,308	3.6	13.9	15
4. Price increase (economic price)	4,893	2,600	74,199	192	13.9	21.2	15
5. Economic price, interest rate 5% farm investment - 10%	4,893	2,600	74,199	+ 25,576	15.0	22.1	5

The feasibility of mixed crop production has been tested for the effects of price and yield changes. While the IRR rates look promising, income generation is still insufficient due to the high financing costs. Also for mixed crop production a number of factors have to be addressed. There is a better possibility to affect the farm gate prices for farmers for maize and other mixed crops than for sugarcane. Therefore, for option 5 the economic price has been used of E 2,600, farm investments have been reduced and the cost of financing set to 5%. Only if and when such changes can be negotiated and introduced is a positive cash flow - in this case of E 27.7 million - possible and available to the community of 2,300 households. Rather than to be discouraged by less promising results of the feasibility study work has to continue to assess other and more feasible options meeting the aspirations of the farming community in the project area. From the analyses it can be concluded that the 100% sugarcane option has better returns than the 100% mixed crops option. Any development scenario combining sugarcane and mixed crops will have returns that are between the extremes shown in the above tables.

6.4 Field Irrigation Systems

6.4.1 Dragline

The drag-line irrigation system is the most frequently applied and most accepted irrigation system in Swaziland. Labour costs higher than solid set.

6.4.2 Solid Set

Solid set irrigation systems are systems which consist of permanently placed pipes and sprinklers. At each sprinkler position, there are laterals with permanent riser points. The sprinklers are connected with a shorter hose pipe usually 1 to 2 m long As with semi-permanent solid set systems, the entire production area under a permanent solid set system is not necessarily irrigated at once. Valves are often used to control flow to individual zones. However, when required for freeze protection, plant establishment, or crop cooling, the entire field may be irrigated at once. In both cases, labour costs for system operation are lower than for dragline and a semi-solid system because water delivery to a zone is controlled by simple opening and closing valves rather than by moving pipe and or sprinklers.

6.4.3 Furrow irrigation

This needs overnight storage and is wasteful in water. Labour costs are high. Erosion hazard, if not properly managed. Not recommended for LUSIP2.

6.4.4 Drip irrigation

It saves water and fertilizer by allowing water to drip slowly to the roots of plants, either onto the soil surface or directly onto the root zone, through a network of valves, pipes, tubing, and emitters. Very complex, has not performed well in the sugarcane industry, even under very good management conditions in the Swazi sugar industry.

6.4.5 Centre pivot

For a centre pivot to be used, the terrain needs to be reasonably flat; but one major advantage of centre pivots over alternative systems is the ability to function in undulating terrain. This advantage has resulted in increased irrigated hectarage and water use in some areas. At pre-feasibility stage, the centre pivot irrigation system has been suggested as one alternative for smallholder irrigation. This proposal has been considered very carefully during the study. At this stage, it is believed that the centre pivot system offers many advantages to a commercial estate farm, such as high field irrigation efficiencies owing to more precise water applications, a more even distribution of water, and cost advantages given that labour costs are drastically reduced. Its use for smallholder farmers must be combined with intensive training. The system is too sophisticated to be operated by smallholder associations. Provided that associations might wish to diversify their cropping pattern at a later stage from a single-cultured type to a more varied multi-cultured one, the centre pivot might be an obstacle rather than a useful irrigation facility. Apart from practical difficulties to cultivate all land in a circle, the centre pivot might become less efficient if more than one crop is to be irrigated. Water applications would have to follow technical criteria instead of crop water requirements and soil characteristics.

6.5 No Project Alternative

During the conceptualization of the project, the LUSIP was planned to be implemented in phases. As such, some of the infrastructure developed under LUSIP I (Lubovane dam and associated infrastructure) were designed for LUSIP I and LUSIP 2. If LUSIP 2 is not implemented, there will be underutilization of the infrastructure, which ultimately would mean that costs incurred were wasted. When the project was initiated, the communities in both LUSIP I and LUSIP 2 were engaged, and the anticipation that project implementation will proceed downstream is high. If the project is not implemented, there community would lose trust on the Swaziland Government and SWADE.

6.6 Preferred Alternative

Implementation of the project on approximately 5,750ha (455ha existing and 5,295ha new land), with 3,477 ha below the main conveyor and 2,273 ha above the conveyor. In order to obtain a realistic overview of the hectarage available of the various land suitability categories, the following modifications need be made considering the position of the land, in particular the height above the canal: (i) eliminate all marginally suitable and suitable land when situated higher than 210m, with exception of the very suitable land; (ii) eliminate all marginally suitable land above the canal at 190m; (iii) select not more than 50% of land classified as N1 very shallow (subject to survey) only below canal (Lower than 190m); and (iv) select all land classified as N1 Vertisols below 210m. From cropping options analyses, it can be concluded that the 100% sugarcane option has better returns than the 100% mixed crops option. Any development scenario combining sugarcane and mixed crops will have returns that are between the extremes.

At this stage, it is believed that the centre pivot system offers many advantages to a commercial estate farm, such as high field irrigation efficiencies owing to more precise water applications, a more even distribution of water, and cost advantages given that labour costs are drastically reduced. Its use for smallholder farmers must be combined with intensive training.

7. STAKEHOLDER CONSULTATION

This section describes the consultation process that took place during the preparation of this ESIA report and identifies stakeholders that have an interest and/or influence on the project. Stakeholder involvement and consultations are important components in the ESIA so as to ensure information is properly conveyed and that cooperation and acceptance from the public is secured. Stakeholder participation should also aim to increase general environmental and social awareness among the communities and various stakeholders in regards to the proposed project and thereby addressing their concerns. Additional reasons for involving the public in the ESIA process include:

- Stakeholder participation is regarded as proper and fair conduct in public decision-making activities.
- Stakeholder participation is widely accepted as a way to ensure that projects meet the stakeholders' needs and are suitable to the affected public.
- The project carries more legitimacy, and less hostility, if potentially affected parties can influence the decision-making process.
- The effectiveness of stakeholder participation is measured by the degree of communication, the intensity of contact and the degree of influence for decision making.

7.1 Stakeholder Participation process:

The stakeholder participation process was carried out during the preparation of the ESIA, where several stakeholder meetings were organized and held in the project area. The process involved the following:

7.1.1 Stakeholder consultation

Concerns that were raised by stakeholders at various stages of the study are addressed in the report. Stakeholders of the project were identified as listed in Appendix 3 of this report.

7.1.2 Stakeholder Identification and Consultation

Concerns that were raised by stakeholders at various stages of the study are addressed in the report. Stakeholders of the project were identified as listed below:

7.1.3 Stakeholder identification

The term "stakeholders" has become common in the ESIA process and stakeholders' participation is important component of the ESIA process. It is one of the key factors that enhance environmental governance. Stakeholders are individuals, groups of individuals or institutions that have interest in the proposed project. This includes those positively and negatively affected by the project. Stakeholder participation involves processes whereby all those with an interest in the outcome of a project actively participate in decisions on planning and management of the proposed development. In conducting the ESIA studies the consultants placed great importance in that the project must be 'inclusive' rather than 'exclusive' and ensure that all those who might be affected or affect the project are fully engaged in the ESIA process. The list of stakeholders consulted is found in Appendix 3 of this report.

7.1.4 Methods of Stakeholder Participation

This ESIA was conducted in all three chiefdoms, as well as in the KDDP, LUSIP 1, NGOs and government ministries. Various methods were used in ensuring that all relevant stakeholders are consulted and their views incorporated in this ESIA report. Participatory methods such as focus group discussion, household questionnaires, interviews and public meetings were used. The team also visited all critical sites and conducted discussions with stakeholders on site to identify their views and concerns.

7.1.5 Notification to Stakeholders

It is important to ensure that stakeholders are well informed prior to undertaking and consultation. Meeting invitations were done by word of mouth through visits and telephone calls by SWADE project staff to all relevant chiefdom administrative units and other national stakeholders to first inform them about the project as well as secure permission to work in the respective communities. The general public was also notified of the project through local newspaper.

7.1.6 Household Questionnaire

Household questionnaires were administered in the chiefdoms to obtain baseline information of the affected population. The information was basically on socio-economic issues, land related issues as well as to obtain their views regarding the project, compensation and

resettlement issues. The household sample was randomly selected but with a focus on households that might be affected by the project.

7.1.7 Community Public Meetings

To ensure that all community members are informed of the project, the team conducted public meetings in all affected communities. The team also ensured that women attended and participated in the meetings. The meeting aimed at informing the members regarding the project and the impacts that are associated with the project. Community members were informed of the positive and negative impacts of the project which include loss of grazing land, possibilities of increase spread of HIV/AIDS especially during the construction phase as well as other environmental and social impacts associated with the project. Members were also sensitized on their right to be compensated and what is to be compensated if they will either lose land, crops and houses. Members were also given an opportunity to ask questions, raise their concerns and provide information to the team on issues such as availability of land in the village for resettlement purposes.

7.1.8 Consultations with Other Relevant Stakeholders

The team also consulted various stakeholders at ministerial, Government Agencies and NGOs to obtain views at policy level. These included the Ministry of Agriculture, Ministry of Economic Planning and Development, SWADE, The Gender Unit under the Deputy Prime Minister's office, Ministry of Health and Social welfare. Various other stakeholders at individual level were also consulted.

7.1.9 Summary of Stakeholder Issues and Concerns

Stakeholders consulted for this specific development project had various views and concerns. Most of the views gathered from the stakeholders are positive about the project and expect that the project will have a positive impact to the economy of the country. Concerns, questions, comments and suggestions regarding many of the aspects of the project were raised by the different participants to the consultation meetings. On the environmental side, an important concern was raised about monoculture and its negative effects.

The first scoping meeting was held on the 7th of December at the Ngcamphalala traditional place (Phafeni Umphakatsi), on the 8th of December another meeting was held at the Matsenjwa community hall and the last one held at the Mngometulu traditional place (Mabantaneni Umphakatsi) on the 10th of December 2011. Two stakeholder validation workshops were held on the 21st June and 4th September 2012 respectively.

During the scoping phase of the project, the following issues were raised during consultations.

Table 52: Summary of Issues raised by Stakeholder

Issue	Approach
Loss of Grazing Area	Issue was investigated further by the livestock specialist as shown in Volume 2, Appendix 5
Loss of Biological diversity	Issue was investigated further by the ecologist as shown in Appendix 4.
Access to Water Supply	Was addressed in the Water and Sanitation component of the project.
Crop Diversity	The project design consultant as well as soil survey investigated different options for crop diversity.
Urbanization and Land Ownership	The social impact specialist investigated issues of changes in land use and land tenure and impacts these may have on the community. The gender and Human rights specialist also investigated this issue in relation to impacts to women and disadvantaged groups.
Poor Performance of Farmers Associations	The social impact specialist investigated social interactions in the community.
Resettlements and Compensation	The resettlement specialist carried out a comprehensive study to identify those that will be relocated by the project, carried out an asset survey and recommended appropriate resettlement options and compensation measures.
Impacts of Climate change to project	A climate change specialist investigated impacts of climate change on the project (Volume 2, appendix 6)
Disruption of Current Household Dynamics and Cultural Structures	The social impact specialist investigated impacts associated with relocation to the community both relocated and host communities. A Resettlement Plan was prepared and presented in Volume 3 of this Report.
Job Opportunities	The Social Baseline Study carried out a skills survey of the local population (Volume 2, Appendix 1)
Community Participation	Participation structures and approaches were presented in the social impact assessment report.
Project Costs and Profitability, sustainability.	The design consulted investigated issues of project costs and profitability and presented options in the feasibility study report.

The photos below depict the stakeholders consulted during the scoping process.

Photoplate 1: A section of participants for the **Ngcamphalala** Scoping meeting held on 7 December 2011 at the traditional place.

Photoplate 2: A section of participants for the **Matsenjwa** Scoping meeting held on 8 December 2011 at the Gamula Community hall

Photoplate 3: A section of the **Mngometulu** community during the scoping meeting held on 10 December 2011 at the Mabantaneni traditional place

7.3 Stakeholder Engagement during Construction and Operation

It is strongly recommended to update and communicate with the various stakeholders during the construction and operational phase. The main objective of this communication is to maintain continued positive community relations and ensure that all interested stakeholders/parties are kept informed on all project activities that may have a positive or negative impact.

The perception of the project by the people including the affected people is positive. They are enthusiastic about the development and hope that the project will play important role in contributing to bring changes in the lifestyle of the local people and believe that it definitely enhances the national economic growth efforts of the country (the minutes of meetings is presented in Appendix 4). The consulted people further stressed the need for mitigating all negative impacts arising from the project development.

8. CONCLUSION AND RECOMMENDATIONS

The ESIA studies concluded that there are no serious environmental flaws that can prevent the implementation of the project and the significant ones can be mitigated against within the ESMP and the RAP. Subject to full resourcing and effective implementation of the measures identified in this report, the project is considered to be in compliance with the African Development Bank (AFDB) IESIA Guidelines (2003); the AFDB ESA Procedure (2001); the AFDB Gender Policy (2001); the AFDB Involuntary Resettlement Policy (2003) and The Government of Swaziland: Swaziland Environment Authority Act, 1992; The World Bank safeguard policies 4.01 Environmental Assessment, 4.04 Natural Habitats, 4.09 Pest Management, OP 4.37 Safety of Dams and 4.11 Physical Cultural Resources; Compliance with the Bank's policy on Involuntary Resettlement (OP 4.12) is the subject of the Resettlement Action Plan which was compiled in consistency with the Bank's policy and Swaziland National legislation and is a separate document, Volume 2 appendix (RAP Compliance with policy OP 7.50 Projects on International Waterways will be handled by the Ministry of Natural Resources and Energy (MNRE) through the Department of Water Affairs.

The project is an initiative to alleviate poverty through the transformation of rain-fed agricultural production systems to irrigated agriculture to improve the living standards of the rural communities in the Lowveld of the country. The prevailing living conditions are unacceptable, poverty is on the rise and the environment is under high stress from many factors such as soil erosion, over exploitation of natural resources and therefore change is imperative. There are already two projects implemented by the proponent which have yielded positive results and therefore the project is highly likely to be a success as long as the mitigation measures are taken into consideration. The project would yield greater benefits it incorporates a more diverse type of irrigated agriculture compared to the monoculture type.

The stakeholders consulted raised concerns on the issue of growing mainly sugarcane at the expense of food crops and yet there are challenges facing the agriculture sector such as climate change and food shortages. This indicates that there is a strong need for the Swaziland Government to conduct a wider Strategic Environment Assessment on agricultural development in the country and to establish stakeholder forums where such issues will be discussed at length as they are beyond the scope of this ESIA. . This need to be done to ensure that agricultural development is planned in line with other competing land and water uses, and taking into account food security and water demand management issues.

There is need for a climate change national framework as it is difficult to implement/plan for adaptation. It is widely agreed that sugarcane will be less vulnerable to climate change due to availability of irrigation water. However, the predicted variability in precipitation and increased temperatures will affect the stream water availability resulting in high demand for water by other sectors as well thereby affecting water supply for agriculture. With the prevailing challenges of climate change, which impact on crop water requirements, there is

need to investigate the commercialization of other crops, which may also be combined with the sugarcane crop, while gradually finding new opportunities for other spin-off businesses. Such an initiative would help curb situations where the sugar price has declined. Priority needs to be accorded to addressing the issue of markets and logistical constraints. Any attempts to support production diversification away from sugar without careful consideration of market and logistical components of the equation, risks jeopardising the sustainability of diversification efforts.

The livestock farmers are concerned about the co-existence of livestock and sugarcane and most of them are not willing to venture into commercial livestock farming due to a number of reasons which include low market prices and cultural values. The current numbers of livestock is also high and therefore, the project will further exacerbate the problem and will result in increased number stock over a very limited area once the sugarcane fields have been developed. Livestock commercialisation and rangeland management requires policy initiatives that would make the livestock industry to be attractive in terms of sustainability and income generation and help control overstocking problems.

The sustainability of the commercial farming in the community is highly dependent on the level of preparation and training of the farmers on business management, forming farmers associations, conflict resolutions, and cost management. Strengthening training and education initiatives not only at farmer level but also at institutions such as research organisations and the Universities is also crucial for the sustainability of these farms.

The areas that require particular attention for this proposed project include: shallow soils, issues of resettlement and compensation, population growth and food security, malaria and HIV/AIDS, conservation of threatened flora and fauna species, water quality, climate change impacts and gender mainstreaming

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